****

Kallambella,

I searched the claims as you suggested as one solid soln. (claims 1 or 6) and also as a mixed phase (L8 + oxides). I also printed some art on sensors and oxygen pumps.

The first ten records that are printed, have the registry number for the perovskite cmpd. of claim 1 or 6. In general I print out the most relevant art first.

If you have any questions, please feel free to call me at your convenience. My ph. # is 703-308-4139.

John

```
=> file hca


FILE 'HCA' ENTERED AT 09:47:30 ON 06 JAN 2004
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FILE COVERS 1907 - 1 Jan 2004 VOL 140 ISS 2
FILE LAST UPDATED: 1 Jan 2004  (20040101/ED)

  This file contains CAS Registry Numbers for easy and accurate
  substance identification.


(FILE 'HOME' ENTERED AT 08:38:03 ON 06 JAN 2004)

     FILE 'HCA' ENTERED AT 08:38:37 ON 06 JAN 2004
L1           24 SEA ABB=ON  PLU=ON  TAMO ?/AU
L2        68278 SEA ABB=ON  PLU=ON  YAMADA ?/AU
L3        14818 SEA ABB=ON  PLU=ON  KURODA ?/AU
L4          348 SEA ABB=ON  PLU=ON  L2 AND L3
L5            1 SEA ABB=ON  PLU=ON  L4 AND L1
                D SCAN
```

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               SEL L5 RN

     FILE 'REGISTRY' ENTERED AT 08:39:21 ON 06 JAN 2004
L6             9 SEA ABB=ON  PLU=ON  (1309-37-1/BI OR 1309-48-4/BI OR 1313-99-1/
                 BI OR 1314-13-2/BI OR 1314-23-4/BI OR 1317-38-0/BI OR 1344-28-1
                 /BI OR 1344-43-0/BI OR 220697-02-9/BI)
                 D SCAN

     FILE 'LREGISTRY' ENTERED AT 08:39:48 ON 06 JAN 2004
L7             0 SEA ABB=ON  PLU=ON  ((LA OR CE OR PR OR ND OR SM)(L)(SR OR CA
                 OR BA)(L)GA(L)O)/ELS(L)4-8/ELC.SUB

     FILE 'REGISTRY' ENTERED AT 08:45:54 ON 06 JAN 2004
L8          1326 SEA ABB=ON  PLU=ON  ((LA OR CE OR PR OR ND OR SM)(L)(SR OR CA
                 OR BA)(L)GA(L)O)/ELS(L)4-8/ELC.SUB
L9        415131 SEA ABB=ON  PLU=ON  TIS/CI
L10         1321 SEA ABB=ON  PLU=ON  L8 AND L9
```

L8 search for cmpd. of claim 1 & 6.

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     FILE 'HCA' ENTERED AT 08:46:50 ON 06 JAN 2004
L11         1049 SEA ABB=ON  PLU=ON  L10
L12       244114 SEA ABB=ON  PLU=ON  FUELCELL? OR BATTERY? OR BATTERIES? OR
                 (FUEL? OR ELECTROCHEM? OR ELECTRO(W)CHEM? OR GALVAN? OR
                 ELECTROLY? OR SECONDAR? OR PRIMAR?)(2A)CELL? OR FC OR SOFC OR
                 DFC OR PEMFC
L13          234 S L11 AND L12
L14       409905 SEA ABB=ON  PLU=ON  CERAMIC? OR SOLID#(2A)STATE##
L15          156 SEA ABB=ON  PLU=ON  L13 AND L14
L16           91 SEA ABB=ON  PLU=ON  L15 AND 1907-2000/PY,PRY
L17       463672 SEA ABB=ON  PLU=ON  57/SX,SC
L18           29 SEA ABB=ON  PLU=ON  L16 AND L17
L19        29400 SEA ABB=ON  PLU=ON  PEROV?
L20            7 SEA ABB=ON  PLU=ON  L18 AND L19
L21           22 SEA ABB=ON  PLU=ON  L18 NOT L20
                 D SCAN
                 S ((LA OR CE OR PR OR ND OR SM)(L)(SR OR CA OR BA)(L)GA(L)O(L)(

     FILE 'REGISTRY' ENTERED AT 09:04:32 ON 06 JAN 2004
L22          970 SEA ABB=ON  PLU=ON  ((LA OR CE OR PR OR ND OR SM)(L)(SR OR CA
                 OR BA)(L)GA(L)O(L)(MG OR AL OR CO OR NI OR FE OR CU))/ELS

     FILE 'HCA' ENTERED AT 09:04:34 ON 06 JAN 2004
L23          624 SEA ABB=ON  PLU=ON  L22
L24            0 SEA ABB=ON  PLU=ON  L23 (L)4-8/ELC.SUB
                 D HSUI
L25          186 SEA ABB=ON  PLU=ON  L23 AND L19
L26          434 SEA ABB=ON  PLU=ON  L23 AND 1907-2000/PY,PRY
L27          118 SEA ABB=ON  PLU=ON  L26 AND L19
L28       244114 SEA ABB=ON  PLU=ON  FUELCELL? OR BATTERY? OR BATTERIES? OR
                 (FUEL? OR ELECTROCHEM? OR ELECTRO(W)CHEM? OR GALVAN? OR
                 ELECTROLY? OR SECONDAR? OR PRIMAR?)(2A)CELL? OR FC OR SOFC OR
                 DFC OR PEMFC
L29            0 SEA ABB=ON  PLU=ON  L27 AND L28]
L30           50 SEA ABB=ON  PLU=ON  L27 AND L28
L31           30 SEA ABB=ON  PLU=ON  L30 AND L14
L32            7 SEA ABB=ON  PLU=ON  L31 AND L17

     FILE 'REGISTRY' ENTERED AT 09:06:57 ON 06 JAN 2004
L33            1 SEA ABB=ON  PLU=ON  L6 AND TIS/CI
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search for cl. 1 or 6.

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L34             8 SEA ABB=ON  PLU=ON  L6 NOT L33
                  D SCAN

     FILE 'HCA' ENTERED AT 09:08:07 ON 06 JAN 2004
L35        428836 SEA ABB=ON  PLU=ON  L34
L36        191442 SEA ABB=ON  PLU=ON  L35(2A)USE#
L37               QUE ABB=ON  PLU=ON  (IRON# OR FERRIC# OR FERROUS## OR FE OR
                  MAGNESIUM# OR MG OR NI OR NICKEL# OR ZN OR ZINC OR COPPER# OR
                  CU OR ZR OR ZIRCONIA# OR MN OR MANGANESE#)(A)OXIDE# OR
                  ZIRCONIA# OR ALUMINA#
L38            23 SEA ABB=ON  PLU=ON  L33
L39            22 SEA ABB=ON  PLU=ON  L38 NOT L32
L40            10 SEA ABB=ON  PLU=ON  L39 AND 1907-2000/PY,PRY
L41             5 SEA ABB=ON  PLU=ON  L40 AND L12
L42             8 SEA ABB=ON  PLU=ON  L40 AND L14
L43             0 SEA ABB=ON  PLU=ON  L40 AND L19
L44             5 SEA ABB=ON  PLU=ON  L40 AND L17
L45            10 SEA ABB=ON  PLU=ON  L41 OR L42 OR L44
L46        218225 SEA ABB=ON  PLU=ON  (L34 OR L37)(2A)USE#
L47          8498 SEA ABB=ON  PLU=ON  L46 AND L12
L48          2169 SEA ABB=ON  PLU=ON  L47 AND L14
L49           112 SEA ABB=ON  PLU=ON  L48 AND L19
L50            40 SEA ABB=ON  PLU=ON  L49 AND L17

     FILE 'LCA' ENTERED AT 09:19:48 ON 06 JAN 2004
L51          2590 SEA ABB=ON  PLU=ON  CONDUCT? OR NONCONDUCT? OR INSULAT? OR
                  DIELECTR? DI(W)ELECTR?
L52           108 SEA ABB=ON  PLU=ON  ION?(2A)L51
L53          2136 SEA ABB=ON  PLU=ON  CONDUCT?

     FILE 'HCA' ENTERED AT 09:25:53 ON 06 JAN 2004
L54        865890 SEA ABB=ON  PLU=ON  CONDUCT?
L55       1075445 SEA ABB=ON  PLU=ON  CONDUCT? OR NONCONDUCT? OR INSULAT? OR
                  DIELECTR? DI(W)ELECTR?
L56         41654 SEA ABB=ON  PLU=ON  ION?(2A)L51
L57             5 SEA ABB=ON  PLU=ON  L20 AND L56
L58             7 SEA ABB=ON  PLU=ON  L57 OR L20
L59             7 SEA ABB=ON  PLU=ON  L21 AND L56
L60            14 SEA ABB=ON  PLU=ON  L58 OR L59
L61             6 SEA ABB=ON  PLU=ON  L45 AND L56
L62            10 SEA ABB=ON  PLU=ON  L61 OR L45
L63             7 SEA ABB=ON  PLU=ON  L58 NOT L62
L64             6 SEA ABB=ON  PLU=ON  L59 NOT (L62 OR L58)
L65             6 SEA ABB=ON  PLU=ON  L50 AND L56
L66             6 SEA ABB=ON  PLU=ON  L65 AND L19
L67        146217 SEA ABB=ON  PLU=ON  SENSOR?
L68             2 SEA ABB=ON  PLU=ON  L66 AND L67
L69             1 SEA ABB=ON  PLU=ON  L21 AND L67
L70             0 SEA ABB=ON  PLU=ON  L69 NOT (L63 OR L64 OR L65)
L71             1 SEA ABB=ON  PLU=ON  L62 AND L67
L72           916 SEA ABB=ON  PLU=ON  (O2 OR OXYGEN#)(2A)(PUMP?)
L73             0 SEA ABB=ON  PLU=ON  (L62 OR L63 OR L64 OR L68) AND L72
L74             1 SEA ABB=ON  PLU=ON  L26 AND L72
                  D SCAN
L75             1 SEA ABB=ON  PLU=ON  L74 AND (L12 OR L14 OR L17)
                  D SCAN
L76            11 SEA ABB=ON  PLU=ON  L62 OR L75
L77           881 SEA ABB=ON  PLU=ON  L11 AND 1907-2001/PY,PRY
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L78           2 SEA ABB=ON  PLU=ON  L77 AND L72
L79           2 SEA ABB=ON  PLU=ON  L78 AND (L12 OR L14 OR L17)
L80           2 SEA ABB=ON  PLU=ON  L75 OR L79
L81           2 SEA ABB=ON  PLU=ON  L80 AND L67

     FILE 'HCA' ENTERED AT 09:42:18 ON 06 JAN 2004
L82         882 SEA ABB=ON  PLU=ON  L8 AND 1907-2001/PY,PRY
L83         280 SEA ABB=ON  PLU=ON  L82 AND L37
L84          77 SEA ABB=ON  PLU=ON  L83 AND L12
L85          56 SEA ABB=ON  PLU=ON  L84 AND L14
L86          15 SEA ABB=ON  PLU=ON  L85 AND L19
L87           2 SEA ABB=ON  PLU=ON  L86 AND (L67 OR L72)
L88           3 SEA ABB=ON  PLU=ON  L81 OR L87
L89           9 SEA ABB=ON  PLU=ON  L86 NOT (L62 OR L63 OR L64 OR L88 OR L68)

     FILE 'HCA' ENTERED AT 09:47:30 ON 06 JAN 2004
                D L62 1-10 CBIB ABS HITIND HITSTR
                D L62 1-7 CBIB ABS HITIND HITSTR
                D L64 1-6 CBIB ABS HITIND HITSTR
                D L88 1-3 CBIB ABS HITIND HITSTR
                D L89 1-9 CBIB ABS HITIND HITRN
```

=> d L62 1-10 cbib abs hitind hitstr

L62 ANSWER 1 OF 10 HCA COPYRIGHT 2004 ACS on STN
136:72293 Solid oxide **electrolyte fuel cell.**
Akikusa, Jun; Tamou, Yoshitaka (Mitsubishi Materials Corporation, Japan). Eur. Pat. Appl. EP 1168478 A2 20020102, 14 pp. DESIGNATED STATES: R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO. (English). CODEN: EPXXDW. APPLICATION: EP 2001-114836 20010628. PRIORITY: JP 2000-193750 20000628.

AB A solid oxide **fuel cell** has an improved efficiency with a solid electrolyte layer having an improved **ionic conductivity**, while maintaining the partition wall function. In order to attain this object, the present invention provides a solid oxide **fuel cell** comprising an air electrode layer, a fuel electrode layer, and a solid electrolyte layer interposed between the air electrode layer and the fuel electrode layer, wherein the solid electrolyte layer comprises a first electrolyte layer which is made of a lanthanide-gallate oxide and has a first ionic transference number and a first total elec. conductivity, and a second electrolyte layer which is made of a lanthanide-gallate oxide and has a second ionic transference number smaller than the first ionic transference number and a second total elec. conductivity larger than the first total elec. conductivity The air electrode layer is laminated onto one side of the solid electrolyte layer; and the fuel electrode layer is laminated onto the other side of the solid electrolyte layer.

IC ICM H01M008-12

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST **fuel cell** solid **electrolyte**

IT **Solid state fuel cells**
(**solid** oxide **electrolyte fuel**

cell)
IT 7440-02-0, Nickel, uses 59989-70-7D, Cobalt samarium strontium oxide CoSm0.5Sr0.5O3, O-deficient 162105-72-8, Cerium samarium oxide Ce0.8Sm0.2O2 203736-04-3D, Cobalt gallium lanthanum magnesium strontium oxide Co0.08Ga0.8La0.9Mg0.12Sr0.1O3, O-deficient **220697-02-9D**, Cobalt gallium lanthanum magnesium strontium oxide Co0.05Ga0.8La0.8Mg0.15Sr0.2O3, O-deficient 383423-12-9D, O-deficient
RL: DEV (Device component use); USES (Uses)
(solid oxide **electrolyte fuel cell**)
IT **220697-02-9D**, Cobalt gallium lanthanum magnesium strontium oxide Co0.05Ga0.8La0.8Mg0.15Sr0.2O3, O-deficient
RL: DEV (Device component use); USES (Uses)
(solid oxide **electrolyte fuel cell**)
RN 220697-02-9 HCA
CN Cobalt gallium lanthanum magnesium strontium oxide (Co0.05Ga0.8La0.8Mg0.15Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.05	7440-48-4
Sr	0.2	7440-24-6
Mg	0.15	7439-95-4
La	0.8	7439-91-0

L62 ANSWER 2 OF 10 HCA COPYRIGHT 2004 ACS on STN

NA

AUTHOR'S RECORD

135:292771 **Ceramic** oxide **ion conductor** for **fuel cell**. Kuroda, Kiyoshi; Yamada, Takashi; Tamo, Yoshitaka; Adachi, Kazunori (Mitsubishi Materials Corp., Japan). Ger. Offen. DE 10108438 A1 20011011, 24 pp. (German). CODEN: GWXXBX. APPLICATION: DE 2001-10108438 20010222. PRIORITY: JP 2000-71759 20000315; JP 2000-213659 20000714.
AB An oxide **ion conductor** with a relatively high mech. firmness is manufactured, with which the **ion conductivity** on a satisfying level is maintained. The oxide **ion conductor** is explained by the formula Ln11-xAxGa1-y-z-wB1yB2zB3wO3-d, where Ln1 is ≥1 element selected from La, Ce, Pr, Nd, and Sm; A is ≥1 element selected from Sr, Ca, and Ba; B1 is ≥1 element from Mg, Al, and In; B2 is ≥1 element selected from Co, Fe, Ni, and Cu; and B3 is ≥1 element selected from Al, Mg, Co, Ni, Fe, Cu, Zn, Mn, and Zr; whereby x = 0.05-0.3, y = 0.025-0.29. z = 0.01-0.15, w = 0.01-0.15, and d = 0.04-0.3.
IC ICM C04B035-50
ICS H01M008-02; G01N027-407; B01D053-22
CC **57-2** (Ceramics)
ST **ceramic** oxide **ion conductor fuel cell**
IT Electric conductors, **ceramic**
(La-Sr-Ga-Mg-Co oxides; **ceramic** oxide **ion conductor** for **fuel cell**)
IT **Solid state fuel cells**
(**ceramic ion conductor** for; **ceramic** oxide **ion conductor** for **fuel cell**)
IT Oxides (inorganic), uses

RL: TEM (Technical or engineered material use); USES (Uses)
(**ion conductors; ceramic** oxide
ion conductor for **fuel cell**)

IT **220697-02-9**, Cobalt gallium lanthanum magnesium strontium oxide (Co0.05Ga0.8La0.8Mg0.15Sr0.2O3)
RL: TEM (Technical or engineered material use); USES (Uses)
(**ceramic ion conductor; ceramic** oxide **ion conductor** for **fuel cell**)

Only cmpd. indexed.

IT 1309-37-1, Ferric oxide, uses 1309-48-4, Magnesium oxide, uses 1313-99-1, Nickel oxide (NiO), uses 1314-13-2, Zinc oxide (ZnO), uses 1314-23-4, Zirconium oxide (ZrO2), uses 1317-38-0, Copper oxide (CuO), uses 1344-28-1, Alumina, uses 1344-43-0, Manganese oxide (MnO), uses
RL: MOA (Modifier or additive use); USES (Uses)
(dopant of **ceramic ion conductor; ceramic** oxide **ion conductor** for **fuel cell**)

Most chemicals ~~cmp~~ indexed as oxides.

IT **220697-02-9**, Cobalt gallium lanthanum magnesium strontium oxide (Co0.05Ga0.8La0.8Mg0.15Sr0.2O3)
RL: TEM (Technical or engineered material use); USES (Uses)
(**ceramic ion conductor; ceramic** oxide **ion conductor** for **fuel cell**)

RN 220697-02-9 HCA
CN Cobalt gallium lanthanum magnesium strontium oxide (Co0.05Ga0.8La0.8Mg0.15Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.05	7440-48-4
Sr	0.2	7440-24-6
Mg	0.15	7439-95-4
La	0.8	7439-91-0

L62 ANSWER 3 OF 10 HCA COPYRIGHT 2004 ACS on STN
135:110892 Porous setter for degreasing and firing and its manufacture. Adachi, Kazunori; Komata, Kiichi (Mitsubishi Materials Corp., Japan). Jpn. Kokai Tokkyo Koho JP 2001192274 A2 20010717, 10 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2000-32572 20000210. PRIORITY: JP 1999-49668 19990226; JP 1999-309631 19991029.

AB The setter has 3-dimension network porous structure having flat surfaces, pores having average diameter 5-1000 μm, and porosity 70-25%. The setter is manufactured by sheet forming from an aqueous slurry containing a water-insol. organic solvent having vapor pressure higher than water, evaporating the solvent to give 3-dimension network porous structure, drying, optionally heating for compressing, and then firing. The process may comprise forming a porous sheet having pore size smaller than the above porous structure by nonfoaming process and then laminating sheet on the porous structure by heat pressing before firing. The lightwt. setter has high strength and desired pore size and is manufactured at low cost without using dies and by preventing gas generation in firing.

IC ICM C04B035-64
ICS C04B038-00; F27D003-12

CC 57-2 (Ceramics)
ST setter manuf org solvent porosity **ceramic** degreasing firing
IT Molding of **ceramics**
Pore size
Pore structure
Porosity
(porous setter for degreasing and firing manufactured by evaporating organic solvent)
IT 1344-28-1, Alumina, processes **220697-02-9** 350480-59-0
350480-60-3 350480-61-4 350480-62-5
RL: PEP (Physical, engineering or chemical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)
(porous setter for degreasing and firing manufactured by evaporating organic solvent)
IT **220697-02-9**
RL: PEP (Physical, engineering or chemical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)
(porous setter for degreasing and firing manufactured by evaporating organic solvent)
RN 220697-02-9 HCA
CN Cobalt gallium lanthanum magnesium strontium oxide (Co0.05Ga0.8La0.8Mg0.15Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.05	7440-48-4
Sr	0.2	7440-24-6
Mg	0.15	7439-95-4
La	0.8	7439-91-0

L62 ANSWER 4 OF 10 HCA COPYRIGHT 2004 ACS on STN
135:79411 Solid oxide **fuel cells.** Tamau, Yoshitaka; Kuroda, Kiyoshi; Yamada, Takashi; Ishihara, Tatsuki; Takida, Yusaku (Mitsubishi Materials Corp., Japan). Jpn. Kokai Tokkyo Koho JP 2001176518 A2 20010629, 12 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1999-354848 19991214.
AB The **fuel cells** comprise air cathodes made of Ln11-xLn2xA1-yCoyO3+d (Ln1 = La, Sm; Ln2 = Ba, Ca; A = Fe, Cu; $0.5 < x < 1.0$; $0 < y < 1.0$; $-0.5 \leq d \leq 0.5$) as oxide **ion conductors.** In the **fuel cells,** the **electrolyte** layers may be made of Ln31-xLn4xGa1-y-zC1yC2zO3-d [Ln3 = La, Ce, Pr, Nd, Sm; Ln4 = Sr, Ca, Ba; C1 = Mg, Al, In; C2 = Co, Fe, Ni, Cu; x = 0.05-0.3; y = 0.025-0.29; z = 0.01-0.15; (y + z) = 0.035-0.3; d = 0.04-0.3], and interlayers are made at the interfaces between the air cathodes and the electrolyte layers. The air cathodes inhibit voltage drop and overvoltage.
IC ICM H01M004-86
ICS H01M008-02; H01M008-12
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
ST **fuel cell** air cathode metal cobalt oxide; barium cobalt oxide **fuel cell** air cathode; calcium cobalt oxide **fuel cell** air cathode; lanthanum cobalt oxide **fuel cell** air cathode; samarium cobalt oxide **fuel cell** air cathode

IT **Fuel cell** cathodes
Fuel cell electrolytes
Solid state fuel cells
(**solid** oxide **fuel cells**)
IT 347356-57-4D, Barium cobalt iron lanthanum oxide
(Ba0.55Co0.25Fe0.75La0.45O3), oxygen-excess 347356-58-5D, Barium cobalt
iron lanthanum oxide (Ba0.55Co0.5Fe0.5La0.45O3), oxygen-excess
347356-59-6D, Barium cobalt iron lanthanum oxide
(Ba0.55Co0.75Fe0.25La0.45O3), oxygen-excess 347356-60-9D, Barium cobalt
iron lanthanum oxide (Ba0.55Co0.9Fe0.1La0.45O3), oxygen-excess
347356-61-0D, Barium cobalt iron lanthanum oxide
(Ba0.55Co0.95Fe0.05La0.45O3), oxygen-excess 347356-62-1D, Barium cobalt
iron lanthanum oxide (Ba0.75Co0.25Fe0.75La0.25O3), oxygen-excess
347356-63-2D, Barium cobalt iron lanthanum oxide
(Ba0.75Co0.5Fe0.5La0.25O3), oxygen-excess 347356-64-3D, Barium cobalt
iron lanthanum oxide (Ba0.75Co0.75Fe0.25La0.25O3), oxygen-excess
347356-65-4D, Barium cobalt iron lanthanum oxide
(Ba0.75Co0.9Fe0.1La0.25O3), oxygen-excess 347356-66-5D, Barium cobalt
iron lanthanum oxide (Ba0.75Co0.95Fe0.05La0.25O3), oxygen-excess
347356-67-6D, Barium cobalt iron lanthanum oxide
(Ba0.95Co0.25Fe0.75La0.05O3), oxygen-excess 347356-68-7D, Barium cobalt
iron lanthanum oxide (Ba0.95Co0.5Fe0.5La0.05O3), oxygen-excess
347356-69-8D, Barium cobalt iron lanthanum oxide
(Ba0.95Co0.75Fe0.25La0.05O3), oxygen-excess 347356-70-1D, Barium cobalt
iron lanthanum oxide (Ba0.95Co0.9Fe0.1La0.05O3), oxygen-excess
347356-71-2D, Barium cobalt iron lanthanum oxide
(Ba0.95Co0.95Fe0.05La0.05O3), oxygen-excess 347356-72-3D, Calcium cobalt
iron lanthanum oxide (Ca0.55Co0.25Fe0.75La0.45O3), oxygen-excess
347356-73-4D, Calcium cobalt iron lanthanum oxide
(Ca0.55Co0.5Fe0.5La0.45O3), oxygen-excess 347356-74-5D, Calcium cobalt
iron lanthanum oxide (Ca0.55Co0.75Fe0.25La0.45O3), oxygen-excess
347356-75-6D, Calcium cobalt iron lanthanum oxide
(Ca0.55Co0.9Fe0.1La0.45O3), oxygen-excess 347356-76-7D, Calcium cobalt
iron lanthanum oxide (Ca0.55Co0.95Fe0.05La0.45O3), oxygen-excess
347356-77-8D, Calcium cobalt iron lanthanum oxide
(Ca0.75Co0.25Fe0.75La0.25O3), oxygen-excess 347356-78-9D, Calcium cobalt
iron lanthanum oxide (Ca0.75Co0.5Fe0.5La0.25O3), oxygen-excess
347356-79-0D, Calcium cobalt iron lanthanum oxide
(Ca0.75Co0.75Fe0.25La0.25O3), oxygen-excess 347356-80-3D, Calcium cobalt
iron lanthanum oxide (Ca0.75Co0.9Fe0.1La0.25O3), oxygen-excess
347356-81-4D, Calcium cobalt iron lanthanum oxide
(Ca0.75Co0.95Fe0.05La0.25O3), oxygen-excess 347356-82-5D, Calcium cobalt
iron lanthanum oxide (Ca0.95Co0.25Fe0.75La0.05O3), oxygen-excess
347356-83-6D, Calcium cobalt iron lanthanum oxide
(Ca0.95Co0.5Fe0.5La0.05O3), oxygen-excess 347356-84-7D, Calcium cobalt
iron lanthanum oxide (Ca0.95Co0.75Fe0.25La0.05O3), oxygen-excess
347356-85-8D, Calcium cobalt iron lanthanum oxide
(Ca0.95Co0.9Fe0.1La0.05O3), oxygen-excess 347356-86-9D, Calcium cobalt
iron lanthanum oxide (Ca0.95Co0.95Fe0.05La0.05O3), oxygen-excess
347356-87-0D, Barium cobalt copper lanthanum oxide
(Ba0.55Co0.25Cu0.75La0.45O3), oxygen-excess 347356-88-1D, Barium cobalt
copper lanthanum oxide (Ba0.55Co0.5Cu0.5La0.45O3), oxygen-excess
347356-89-2D, Barium cobalt copper lanthanum oxide
(Ba0.55Co0.75Cu0.25La0.45O3), oxygen-excess 347356-90-5D, Barium cobalt
copper lanthanum oxide (Ba0.55Co0.9Cu0.1La0.45O3), oxygen-excess
347356-91-6D, Barium cobalt copper lanthanum oxide
(Ba0.55Co0.95Cu0.05La0.45O3), oxygen-excess 347356-92-7D, Barium cobalt
copper lanthanum oxide (Ba0.75Co0.25Cu0.75La0.25O3), oxygen-excess

copper samarium oxide (Ca0.75Co0.9Cu0.1Sm0.25O3), oxygen-excess
347357-71-5D, Calcium cobalt copper samarium oxide
(Ca0.75Co0.95Cu0.05Sm0.25O3), oxygen-excess 347357-72-6D, Calcium cobalt
copper samarium oxide (Ca0.95Co0.25Cu0.75Sm0.05O3), oxygen-excess
347357-73-7D, Calcium cobalt copper samarium oxide
(Ca0.95Co0.5Cu0.5Sm0.05O3), oxygen-excess 347357-74-8D, Calcium cobalt
copper samarium oxide (Ca0.95Co0.75Cu0.25Sm0.05O3), oxygen-excess
347357-75-9D, Calcium cobalt copper samarium oxide
(Ca0.95Co0.9Cu0.1Sm0.05O3), oxygen-excess 347357-76-0D, Calcium cobalt
copper samarium oxide (Ca0.95Co0.95Cu0.05Sm0.05O3), oxygen-excess
RL: DEV (Device component use); USES (Uses)
(air cathodes; solid oxide **fuel cells**)

IT **220697-02-9D**, oxygen-deficient
RL: DEV (Device component use); USES (Uses)
(electrolytes; solid oxide **fuel cells**)

IT **220697-02-9D**, oxygen-deficient
RL: DEV (Device component use); USES (Uses)
(electrolytes; solid oxide **fuel cells**)

RN 220697-02-9 HCA

CN Cobalt gallium lanthanum magnesium strontium oxide
(Co0.05Ga0.8La0.8Mg0.15Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.05	7440-48-4
Sr	0.2	7440-24-6
Mg	0.15	7439-95-4
La	0.8	7439-91-0

L62 ANSWER 5 OF 10 HCA COPYRIGHT 2004 ACS on STN

134:181075 Solid oxide **fuel cells.** Tamai, Yoshitaka;
Kuroda, Kiyoshi; Komata, Norikazu (Mitsubishi Materials Corp., Japan).
Jpn. Kokai Tokkyo Koho JP 2001052722 A2 20010223, 7 pp. (Japanese).
CODEN: JKXXAF. APPLICATION: JP 1999-228446 19990812.

AB The **fuel cells** have M1-xAxGa1-y-zA'yA"zO3-d [M = La,
Ce, Pr, Nd, and/or Sm; A = Sr, Ca, and/or Ba; A' = Mg, Al, and/or In; A" =
Co, Fe, Ni, and/or Cu; x = 0.05-0.3; yr =0.025-0.29; z =0.01-0.15; 9y+z)
=0.035-0.3; and d =0.04-0.3] electrolyte layers, M'1-x'Srx'Co1-y'Xy'O3-d'
(M' = La and/or Sm, X = Fe and/or Cu, x' = 0.05-0.8, yr' = 0-0.9, d'
=0.04-0.3) cathode layers, and an intermediate layer between the 2. The
intermediate layer is preferably M1-x-pAxSmpGa1-y-z-qA'yA"zCoqO3-d [p =
0-0.2, q = 0-0.1, and (p+q) =0.01-0.3].

IC ICM H01M008-02
ICS C01G051-00; H01M004-86; H01M008-12

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST solid **electrolyte fuel cell** cathode
electrolyte intermediate layer

IT **Solid state fuel cells**
(**solid electrolyte fuel cells**
containing intermediate layers between electrolyte and cathode layers)

IT **220697-02-9D**, oxygen deficit
RL: DEV (Device component use); USES (Uses)
(intermediate layers between electrolyte and cathode layers in solid
electrolyte fuel cells)

IT 59989-70-7D, Cobalt samarium strontium oxide (Co2SmSrO6), oxygen deficit
220697-02-9 326923-61-9D, oxygen deficit
RL: DEV (Device component use); USES (Uses)
(solid **electrolyte fuel cells** containing
intermediate layers between electrolyte and cathode layers)

IT **220697-02-9D**, oxygen deficit
RL: DEV (Device component use); USES (Uses)
(intermediate layers between electrolyte and cathode layers in solid
electrolyte fuel cells)

RN 220697-02-9 HCA

CN Cobalt gallium lanthanum magnesium strontium oxide
(Co0.05Ga0.8La0.8Mg0.15Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.05	7440-48-4
Sr	0.2	7440-24-6
Mg	0.15	7439-95-4
La	0.8	7439-91-0

IT **220697-02-9**
RL: DEV (Device component use); USES (Uses)
(solid **electrolyte fuel cells** containing
intermediate layers between electrolyte and cathode layers)

RN 220697-02-9 HCA

CN Cobalt gallium lanthanum magnesium strontium oxide
(Co0.05Ga0.8La0.8Mg0.15Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.05	7440-48-4
Sr	0.2	7440-24-6
Mg	0.15	7439-95-4
La	0.8	7439-91-0

L62 ANSWER 6 OF 10 HCA COPYRIGHT 2004 ACS on STN

133:246054 Oxide **ion conductors** and manufacturing
conductors thereof. Kuroda, Kiyoshi; Tamai, Yoshitaka; Tanaka, Kazunori;
Komada, Norikazu (Mitsubishi Materials Corp., Japan). Jpn. Kokai Tokkyo
Koho JP 2000251535 A2 **20000914**, 9 pp. (Japanese). CODEN:
JKXXAF. APPLICATION: JP 1999-49667 19990226.

AB The title conductors are Ln1-xAxGa1-y-zB1yB2zO3-d (Ln = La, Ce, Pr, Nd,
Sm; A = Sr, Ca, Ba; B1 = Mg, Al, In; B2 = Co, Fe, Ni, Cu; x =0.05-0.3; y =
0.025-0.29; z = 0.01-0.15; (y+z) =0.035-0.3, d =0.04-0.3) which consists
of ≥30 volume% crystal grain size 0.25-2.0 μm which is packed
among larger-size remainder crystal grains. The oxide **conductors**
provides high **ion conductivity** in an wire temperature range without
decrease of elec. conductivity

IC ICM H01B001-08
ICS B01D053-22; B01D071-02; G01N027-409; H01M008-02

CC 76-2 (Electric Phenomena)

Section cross-reference(s): **57**, 72
ST lanthanum strontium gallium magnesium cobalt oxide **ion conductor**
IT Electric **conductivity**
Ionic conductivity
Ionic conductors
(oxide **ion conductors** and manufacturing conductors thereof)
IT **220697-02-9DP**, Cobalt gallium lanthanum magnesium strontium oxide ($Co_{0.05}Ga_{0.8}La_{0.8}Mg_{0.15}Sr_{0.2}O_3$), oxygen-deficient 293736-68-2DP, oxygen-deficient
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PNU (Preparation, unclassified); PRP (Properties); PREP (Preparation); PROC (Process); USES (Uses)
(**ionic conductor**; oxide **ion conductors** and manufacturing conductors thereof)
IT **220697-02-9DP**, Cobalt gallium lanthanum magnesium strontium oxide ($Co_{0.05}Ga_{0.8}La_{0.8}Mg_{0.15}Sr_{0.2}O_3$), oxygen-deficient
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PNU (Preparation, unclassified); PRP (Properties); PREP (Preparation); PROC (Process); USES (Uses)
(**ionic conductor**; oxide **ion conductors** and manufacturing conductors thereof)
RN 220697-02-9 HCA
CN Cobalt gallium lanthanum magnesium strontium oxide ($Co_{0.05}Ga_{0.8}La_{0.8}Mg_{0.15}Sr_{0.2}O_3$) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.05	7440-48-4
Sr	0.2	7440-24-6
Mg	0.15	7439-95-4
La	0.8	7439-91-0

L62 ANSWER 7 OF 10 HCA COPYRIGHT 2004 ACS on STN
133:246053 Oxide **ion conductors**, manufacturing, and uses of conductors thereof. Yamada, Ikiko; Adachi, Kazunori; Akikusa, Osamu; Komata, Norikazu (Mitsubishi Materials Corp., Japan). Jpn. Kokai Tokkyo Koho JP 2000251534 A2 **20000914**, 9 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1999-49318 19990226.
AB The title conductors are $Ln_{1-x}Sr_xGa_{1-(y+z)}Mg_yCo_zO_3$ (Ln = La, Nd; x = 0.01-0.3, y =0-0.29, z =0.01-0.3, yr+z =0.025) and are manufactured with powdered Co_3O_4 and optionally mixed with CoO. The title conductors are applicable to air electrodes, gas sensors, oxygen separator membranes, and gas separator membranes.
IC ICM H01B001-08
ICS B01D053-22; C01G051-00; G01N027-409; H01M008-02
CC 76-2 (Electric Phenomena)
Section cross-reference(s): 47, 52, **57**, 72
ST lanthanum gallium strontium cobalt magnesium oxide **ionic conductor**; neodymium gallium strontium cobalt magnesium oxide **ionic conductor**; air electrode gas oxygen sepn membrane **ion conductor**

IT Electrodes
(air; oxide **ion conductors**, manufacturing, and uses of conductors thereof)
IT Membranes, nonbiological
(gas, oxygen; oxide **ion conductors**, manufacturing, and uses of conductors thereof)
IT Gas sensors
Ionic conductivity
(oxide **ion conductors**, manufacturing, and uses of conductors thereof)
IT **Ionic conductors**
Sintering
(oxides; oxide **ion conductors**, manufacturing, and uses of conductors thereof)
IT **220697-02-9P**, Cobalt gallium lanthanum magnesium strontium oxide Co0.05Ga0.8La0.8Mg0.15Sr0.2O3
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PNU (Preparation, unclassified); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); PROC (Process); USES (Uses)
(oxide **ion conductors**, manufacturing, and uses of conductors thereof)
IT 1307-96-6, Cobaltous oxide, reactions 1308-06-1, Cobalt oxide (Co3O4)
RL: RCT (Reactant); RACT (Reactant or reagent)
(oxide **ion conductors**, manufacturing, and uses of conductors thereof)
IT **220697-02-9P**, Cobalt gallium lanthanum magnesium strontium oxide Co0.05Ga0.8La0.8Mg0.15Sr0.2O3
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PNU (Preparation, unclassified); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); PROC (Process); USES (Uses)
(oxide **ion conductors**, manufacturing, and uses of conductors thereof)
RN 220697-02-9 HCA
CN Cobalt gallium lanthanum magnesium strontium oxide (Co0.05Ga0.8La0.8Mg0.15Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.05	7440-48-4
Sr	0.2	7440-24-6
Mg	0.15	7439-95-4
La	0.8	7439-91-0

L62 ANSWER 8 OF 10 HCA COPYRIGHT 2004 ACS on STN
131:187290 The use of **solid state** NMR and Rutherford back scattering to study La0.8Sr0.2Ga0.85-xCoxMg0.15O3-δ. Sammes, N. M.; Markwitz, A.; Keppeler, F. M.; Tompsett, G. A. (The Department of Technology, The University of Waikato, Hamilton, N. Z.). Proceedings - Electrochemical Society, 99-19(Solid Oxide Fuel Cells (SOFC VI)), 292-301 (English) **1999**. CODEN: PESODO. ISSN: 0161-6374. Publisher: Electrochemical Society.
AB Rutherford backscattering spectroscopy (RBS) and **solid-**

state NMR studies were undertaken on **solid-state** synthesized La0.8Sr0.2Ga0.85-xCoxMg0.15O3-δ. The materials that were fabricated revealed phase purity, and a high relative d. of more than 97%. RBS, and non-resonant nuclear reaction anal. (such as the use of the 16O(d,p)17O reaction at 0.92 MeV) measurements revealed the compositional structure of the Co-doped lanthanum gallates. However, detecting oxygen depth profiles, especially 16O, with high accuracy is not straight forward, unless the exptl. set-up is changed to resonant backscattering spectrometry. Resonant backscattering measurements yielded an oxygen concentration of 55 atomic% in some of the lanthanum gallates, and was independent of the amount of Co present. Preliminary studies using Co-59 MAS NMR spectroscopy of the samples showed that Co3+ is present in La0.8Sr0.2Ga0.85-xCoxMg0.15O3-δ at concns. as low as x = 0.05.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 73

ST **fuel cell electrolyte** lanthanum magnesium gallate; NMR lanthanum magnesium gallate; Rutherford back scattering lanthanum magnesium gallate

IT NMR spectroscopy
(**solid state**; use of **solid state** NMR and Rutherford back scattering to study La0.8Sr0.2Ga0.85-xCoxMg0.15O3-δ)

IT Rutherford backscattering spectroscopy
(use of **solid state** NMR and Rutherford back scattering to study La0.8Sr0.2Ga0.85-xCoxMg0.15O3-δ)

IT **220697-02-9D**, Cobalt gallium lanthanum magnesium strontium oxide Co0.05Ga0.8La0.8Mg0.15Sr0.2O3, oxygen-deficient 220697-03-0D, Cobalt gallium lanthanum magnesium strontium oxide Co0.15Ga0.7La0.8Mg0.15Sr0.2O3, oxygen-deficient 220697-04-1, Cobalt gallium lanthanum magnesium strontium oxide Co0.25Ga0.6La0.8Mg0.15Sr0.2O3
RL: DEV (Device component use); PRP (Properties); USES (Uses)
(use of **solid state** NMR and Rutherford back scattering to study La0.8Sr0.2Ga0.85-xCoxMg0.15O3-δ)

IT **220697-02-9D**, Cobalt gallium lanthanum magnesium strontium oxide Co0.05Ga0.8La0.8Mg0.15Sr0.2O3, oxygen-deficient
RL: DEV (Device component use); PRP (Properties); USES (Uses)
(use of **solid state** NMR and Rutherford back scattering to study La0.8Sr0.2Ga0.85-xCoxMg0.15O3-δ)

RN 220697-02-9 HCA

CN Cobalt gallium lanthanum magnesium strontium oxide (Co0.05Ga0.8La0.8Mg0.15Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.05	7440-48-4
Sr	0.2	7440-24-6
Mg	0.15	7439-95-4
La	0.8	7439-91-0

L62 ANSWER 9 OF 10 HCA COPYRIGHT 2004 ACS on STN
131:163716 Improved Oxide **Ion Conductivity** in La0.8Sr0.2Ga0.8Mg0.2O3 by Doping Co. Ishihara, Tatsumi; Furutani, Haruyoshi; Honda, Miho; Yamada, Takashi; Shibayama, Takaaki; Akbay, Taner;

Sakai, Natsuko; Yokokawa, Harumi; Takita, Yusaku (Department of Applied Chemistry Faculty of Engineering, Oita University, Oita, 870-1192, Japan).
Chemistry of Materials, 11(8), 2081-2088 (English) **1999**. CODEN: CMATEX. ISSN: 0897-4756. Publisher: American Chemical Society.

AB The effects of doping Co for the Ga site on the oxide **ion conductivity** of La0.8Sr0.2Ga0.8Mg0.2O3 have been investigated in detail. It was found that doping Co is effective for enhancing the oxide **ion conductivity** In particular, a significant increase in conductivity in the low-temperature range was observed The elec. conductivity was monotonically increased; however, the transport number for the oxide ion decreased with an increasing amount of Co. Considering the transport number and ion transport number, an optimized amount for the Co doping seems to exist at 8.5 mol % for Ga site. The theor. electromotive forces were exhibited on H2-O2 gas cell utilizing the optimized composition of La0.8Sr0.2Ga0.8Mg0.115Co0.085O3. The diffusion characteristics of the oxide ion in La0.8Sr0.2Ga0.8Mg0.115Co0.085O3 were also investigated by using the 18O tracer method. Since the diffusion coefficient measured by the 18O tracer method was similar to that estimated by the elec. conductivity, the conduction of La0.8Sr0.2Ga0.8Mg0.115Co0.085O3 is concluded to be almost ionic. On the other hand, an oxygen permeation measurement suggests that the oxide **ion conductivity** increased linearly with an increasing amount of Co. Therefore, specimens with Co content higher than 10 mol % can be considered as a superior mixed oxide **ion** and hole **conductor**. The UV-vis spectra suggests that the valence number of doped Co was changed from +3 to +2 with decreasing oxygen partial pressure; the origin of hole conduction can thus be assigned to the formation of Co3+. Since the amount of dopant in the Ga site was compensated with Mg2+, the amount of oxygen deficiency was decreased by doping Co. Therefore, it is likely that the improved oxide **ion conductivity** observed by doping with Co is brought about by the enhanced mobility of oxide ion.

CC 76-1 (Electric Phenomena)
Section cross-reference(s): **57**, 69, 75

ST **ionic cond** gallium magnesium lanthanum strontium oxide cobalt doped

IT Temperature
(effect on **ionic conductivity** of Co doped La0.8Sr0.2Ga0.8Mg0.2O3)

IT **Ionic conductivity**
(oxide **ion conductivity** of Co doped La0.8Sr0.2Ga0.8Mg0.2O3)

IT 165900-07-2, Gallium lanthanum magnesium strontium oxide (Ga0.8La0.8Mg0.2Sr0.2O3)
RL: FMU (Formation, unclassified); PRP (Properties); FORM (Formation, nonpreparative)
(Co doped; improved oxide **ion conductivity** in La0.8Sr0.2Ga0.8Mg0.2O3 by doping Co)

IT 203736-00-9 220667-93-6 **220697-02-9** 237736-09-3 237736-10-6, Cobalt gallium lanthanum strontium oxide (Co0.2Ga0.8La0.8Sr0.2O3)
RL: FMU (Formation, unclassified); PRP (Properties); FORM (Formation, nonpreparative)
(crystal structure and oxide **ion conductivity** in)

IT 7440-48-4, Cobalt, properties
RL: MOA (Modifier or additive use); PRP (Properties); USES (Uses)
(improved oxide **ion conductivity** in La0.8Sr0.2Ga0.8Mg0.2O3

by doping Co)
IT 1307-96-6, Cobalt oxide CoO, properties 1309-48-4, Magnesium oxide, properties 1312-81-8, Lanthanum oxide 1633-05-2, Strontium carbonate 12024-21-4, Gallium oxide
RL: PRP (Properties); RCT (Reactant); RACT (Reactant or reagent)
(use in formation of Co doped La0.8Sr0.2Ga0.8Mg0.2O3 by **solid state** reaction)
IT **220697-02-9**
RL: FMU (Formation, unclassified); PRP (Properties); FORM (Formation, nonpreparative)
(crystal structure and oxide **ion conductivity** in)
RN 220697-02-9 HCA
CN Cobalt gallium lanthanum magnesium strontium oxide (Co0.05Ga0.8La0.8Mg0.15Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.05	7440-48-4
Sr	0.2	7440-24-6
Mg	0.15	7439-95-4
La	0.8	7439-91-0

L62 ANSWER 10 OF 10 HCA COPYRIGHT 2004 ACS on STN
130:203324 Mixed conductivity in Co-doped lanthanum gallate. Keppeler, F. Michael; Sammes, Nigel M.; Naefe, Helfried; Aldinger, Fritz (Pulvermetallurgisches Laboratorium, Max-Planck-Institut Metallforschung, Stuttgart, D-70569, Germany). Journal of the Australasian Ceramic Society, 34(1), 106-111 (English) **1998**. CODEN: JAUSEL. ISSN: 1018-6689. Publisher: Australasian Ceramic Society.
AB Materials La0.8Sr0.2Ga0.85-xCoxMg0.15O3-δ (x = 0-0.25) were synthesized using standard **solid-state** technique resulting in phase purity and high d. Conductivity measurements at different temps. and O2 partial pressures revealed an ionic to metallic-like transition in conduction behavior with rising Co amount Samples with low Co contents (x = 0.05) showed ionic behavior with an average value of 0.15 S/cm at 900° while heavy doping (x = 0.25) resulted in metallic-type conduction with a value of 5.43 S/cm at 900° in air.
CC 76-1 (Electric Phenomena)
Section cross-reference(s): 78
IT 177027-88-2DP, Gallium lanthanum magnesium strontium oxide (Ga0.85La0.8Mg0.15Sr0.2O3), oxygen-deficient **220697-02-9DP**, oxygen-deficient 220697-03-0DP, oxygen-deficient 220697-04-1DP, oxygen-deficient
RL: PEP (Physical, engineering or chemical process); PRP (Properties); SPN (Synthetic preparation); PREP (Preparation); PROC (Process)
(mixed elec. conductivity in Co-doped lanthanum strontium gallium magnesium oxides)
IT **220697-02-9DP**, oxygen-deficient
RL: PEP (Physical, engineering or chemical process); PRP (Properties); SPN (Synthetic preparation); PREP (Preparation); PROC (Process)
(mixed elec. conductivity in Co-doped lanthanum strontium gallium magnesium oxides)
RN 220697-02-9 HCA

CN Cobalt gallium lanthanum magnesium strontium oxide
(Co0.05Ga0.8La0.8Mg0.15Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.05	7440-48-4
Sr	0.2	7440-24-6
Mg	0.15	7439-95-4
La	0.8	7439-91-0

=> d L62 1-7 cbib abs hitind hitstr

L62 ANSWER 1 OF 10 HCA COPYRIGHT 2004 ACS on STN
136:72293 Solid oxide **electrolyte fuel cell.**
Akikusa, Jun; Tamou, Yoshitaka (Mitsubishi Materials Corporation, Japan). Eur. Pat. Appl. EP 1168478 A2 20020102, 14 pp. DESIGNATED STATES: R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO. (English). CODEN: EPXXDW. APPLICATION: EP 2001-114836 20010628. PRIORITY: JP 2000-193750 20000628.

AB A solid oxide **fuel cell** has an improved efficiency with a solid electrolyte layer having an improved **ionic conductivity**, while maintaining the partition wall function. In order to attain this object, the present invention provides a solid oxide **fuel cell** comprising an air electrode layer, a fuel electrode layer, and a solid electrolyte layer interposed between the air electrode layer and the fuel electrode layer, wherein the solid electrolyte layer comprises a first electrolyte layer which is made of a lanthanide-gallate oxide and has a first ionic transference number and a first total elec. conductivity, and a second electrolyte layer which is made of a lanthanide-gallate oxide and has a second ionic transference number smaller than the first ionic transference number and a second total elec. conductivity larger than the first total elec. conductivity The air electrode layer is laminated onto one side of the solid electrolyte layer; and the fuel electrode layer is laminated onto the other side of the solid electrolyte layer.

IC ICM H01M008-12
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
ST **fuel cell** solid **electrolyte**
IT **Solid state fuel cells**
(**solid** oxide **electrolyte fuel cell**)
IT 7440-02-0, Nickel, uses 59989-70-7D, Cobalt samarium strontium oxide CoSm0.5Sr0.5O3, O-deficient 162105-72-8, Cerium samarium oxide Ce0.8Sm0.2O2 203736-04-3D, Cobalt gallium lanthanum magnesium strontium oxide Co0.08Ga0.8La0.9Mg0.12Sr0.1O3, O-deficient **220697-02-9D**, Cobalt gallium lanthanum magnesium strontium oxide Co0.05Ga0.8La0.8Mg0.15Sr0.2O3, O-deficient 383423-12-9D, O-deficient
RL: DEV (Device component use); USES (Uses)
(solid oxide **electrolyte fuel cell**)
IT **220697-02-9D**, Cobalt gallium lanthanum magnesium strontium oxide Co0.05Ga0.8La0.8Mg0.15Sr0.2O3, O-deficient
RL: DEV (Device component use); USES (Uses)

(solid oxide **electrolyte fuel cell**)
RN 220697-02-9 HCA
CN Cobalt gallium lanthanum magnesium strontium oxide
(Co0.05Ga0.8La0.8Mg0.15Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.05	7440-48-4
Sr	0.2	7440-24-6
Mg	0.15	7439-95-4
La	0.8	7439-91-0

L62 ANSWER 2 OF 10 HCA COPYRIGHT 2004 ACS on STN
135:292771 **Ceramic** oxide **ion conductor** for **fuel cell.** Kuroda, Kiyoshi; Yamada, Takashi; Tamo, Yoshitaka; Adachi, Kazunori (Mitsubishi Materials Corp., Japan). Ger. Offen. DE 10108438 A1 20011011, 24 pp. (German). CODEN: GWXXBX. APPLICATION: DE 2001-10108438 20010222. PRIORITY: JP 2000-71759 20000315; JP 2000-213659 20000714. NO

AB An oxide **ion conductor** with a relatively high mech. firmness is manufactured, with which the **ion conductivity** on a satisfying level is maintained. The oxide **ion conductor** is explained by the formula Ln11-xAxGa1-y-z-wB1yB2zB3wO3-d, where Ln1 is ≥1 element selected from La, Ce, Pr, Nd, and Sm; A is ≥1 element selected from Sr, Ca, and Ba; B1 is ≥1 element from Mg, Al, and In; B2 is ≥1 element selected from Co, Fe, Ni, and Cu; and B3 is ≥1 element selected from Al, Mg, Co, Ni, Fe, Cu, Zn, Mn, and Zr; whereby x = 0.05-0.3, y = 0.025-0.29. z = 0.01-0.15, w = 0.01-0.15, and d = 0.04-0.3.

IC ICM C04B035-50
ICS H01M008-02; G01N027-407; B01D053-22
CC **57-2** (Ceramics)
ST **ceramic** oxide **ion conductor fuel cell**
IT Electric conductors, **ceramic**
(La-Sr-Ga-Mg-Co oxides; **ceramic** oxide **ion conductor** for **fuel cell**)
IT **Solid state fuel cells**
(**ceramic ion conductor** for; **ceramic** oxide **ion conductor** for **fuel cell**)
IT Oxides (inorganic), uses
RL: TEM (Technical or engineered material use); USES (Uses)
(**ion conductors; ceramic** oxide **ion conductor** for **fuel cell**)
IT **220697-02-9**, Cobalt gallium lanthanum magnesium strontium oxide (Co0.05Ga0.8La0.8Mg0.15Sr0.2O3)
RL: TEM (Technical or engineered material use); USES (Uses)
(**ceramic ion conductor; ceramic** oxide **ion conductor** for **fuel cell**)

IT 1309-37-1, Ferric oxide, uses 1309-48-4, Magnesium oxide, uses 1313-99-1, Nickel oxide (NiO), uses 1314-13-2, Zinc oxide (ZnO), uses 1314-23-4, Zirconium oxide (ZrO2), uses 1317-38-0, Copper oxide (CuO),

uses 1344-28-1, Alumina, uses 1344-43-0, Manganese oxide (MnO), uses
RL: MOA (Modifier or additive use); USES (Uses)
(dopant of **ceramic ion conductor;**
ceramic oxide **ion conductor** for
fuel cell)

IT **220697-02-9**, Cobalt gallium lanthanum magnesium strontium oxide (Co0.05Ga0.8La0.8Mg0.15Sr0.2O3)
RL: TEM (Technical or engineered material use); USES (Uses)
(**ceramic ion conductor; ceramic**
oxide **ion conductor** for **fuel cell**
)

RN 220697-02-9 HCA
CN Cobalt gallium lanthanum magnesium strontium oxide (Co0.05Ga0.8La0.8Mg0.15Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.05	7440-48-4
Sr	0.2	7440-24-6
Mg	0.15	7439-95-4
La	0.8	7439-91-0

L62 ANSWER 3 OF 10 HCA COPYRIGHT 2004 ACS on STN
135:110892 Porous setter for degreasing and firing and its manufacture.
Adachi, Kazunori; Komata, Kiichi (Mitsubishi Materials Corp., Japan). Jpn. Kokai Tokkyo Koho JP 2001192274 A2 20010717, 10 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2000-32572 20000210. PRIORITY: JP 1999-49668 19990226; JP 1999-309631 19991029.

AB The setter has 3-dimension network porous structure having flat surfaces, pores having average diameter 5-1000 μm, and porosity 70-25%. The setter is manufactured by sheet forming from an aqueous slurry containing a water-insol. organic solvent having vapor pressure higher than water, evaporating the solvent to give 3-dimension network porous structure, drying, optionally heating for compressing, and then firing. The process may comprise forming a porous sheet having pore size smaller than the above porous structure by nonfoaming process and then laminating sheet on the porous structure by heat pressing before firing. The lightwt. setter has high strength and desired pore size and is manufactured at low cost without using dies and by preventing gas generation in firing.

IC ICM C04B035-64
ICS C04B038-00; F27D003-12
CC **57-2** (Ceramics)
ST setter manuf org solvent porosity **ceramic** degreasing firing
IT Molding of **ceramics**
Pore size
Pore structure
Porosity
(porous setter for degreasing and firing manufactured by evaporating organic solvent)

IT 1344-28-1, Alumina, processes **220697-02-9** 350480-59-0
350480-60-3 350480-61-4 350480-62-5
RL: PEP (Physical, engineering or chemical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)

(porous setter for degreasing and firing manufactured by evaporating organic solvent)

IT **220697-02-9**

RL: PEP (Physical, engineering or chemical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)

(porous setter for degreasing and firing manufactured by evaporating organic solvent)

RN 220697-02-9 HCA

CN Cobalt gallium lanthanum magnesium strontium oxide (Co0.05Ga0.8La0.8Mg0.15Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.05	7440-48-4
Sr	0.2	7440-24-6
Mg	0.15	7439-95-4
La	0.8	7439-91-0

L62 ANSWER 4 OF 10 HCA COPYRIGHT 2004 ACS on STN

135:79411 Solid oxide **fuel cells**. Tamau, Yoshitaka; Kuroda, Kiyoshi; Yamada, Takashi; Ishihara, Tatsuki; Takida, Yusaku (Mitsubishi Materials Corp., Japan). Jpn. Kokai Tokkyo Koho JP 2001176518 A2 20010629, 12 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1999-354848 19991214. NA

AB The **fuel cells** comprise air cathodes made of Ln11-xLn2xA1-yCoyO3+d (Ln1 = La, Sm; Ln2 = Ba, Ca; A = Fe, Cu; 0.5 < x < 1.0; 0 < y < 1.0; -0.5 ≤ d ≤ 0.5) as oxide **ion conductors**. In the **fuel cells**, the **electrolyte** layers may be made of Ln31-xLn4xGa1-y-zC1yC2zO3-d [Ln3 = La, Ce, Pr, Nd, Sm; Ln4 = Sr, Ca, Ba; C1 = Mg, Al, In; C2 = Co, Fe, Ni, Cu; x = 0.05-0.3; y = 0.025-0.29; z = 0.01-0.15; (y + z) = 0.035-0.3; d = 0.04-0.3], and interlayers are made at the interfaces between the air cathodes and the electrolyte layers. The air cathodes inhibit voltage drop and overvoltage.

IC ICM H01M004-86

ICS H01M008-02; H01M008-12

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST **fuel cell** air cathode metal cobalt oxide; barium cobalt oxide **fuel cell** air cathode; calcium cobalt oxide **fuel cell** air cathode; lanthanum cobalt oxide **fuel cell** air cathode; samarium cobalt oxide **fuel cell** air cathode

IT **Fuel cell** cathodes

Fuel cell electrolytes

Solid state fuel cells

(**solid** oxide **fuel cells**)

IT 347356-57-4D, Barium cobalt iron lanthanum oxide (Ba0.55Co0.25Fe0.75La0.45O3), oxygen-excess 347356-58-5D, Barium cobalt iron lanthanum oxide (Ba0.55Co0.5Fe0.5La0.45O3), oxygen-excess 347356-59-6D, Barium cobalt iron lanthanum oxide (Ba0.55Co0.75Fe0.25La0.45O3), oxygen-excess 347356-60-9D, Barium cobalt iron lanthanum oxide (Ba0.55Co0.9Fe0.1La0.45O3), oxygen-excess 347356-61-0D, Barium cobalt iron lanthanum oxide (Ba0.55Co0.95Fe0.05La0.45O3), oxygen-excess 347356-62-1D, Barium cobalt

IT **220697-02-9D**, oxygen-deficient
RL: DEV (Device component use); USES (Uses)
(electrolytes; solid oxide **fuel cells**)
IT **220697-02-9D**, oxygen-deficient
RL: DEV (Device component use); USES (Uses)
(electrolytes; solid oxide **fuel cells**)
RN 220697-02-9 HCA
CN Cobalt gallium lanthanum magnesium strontium oxide
(Co0.05Ga0.8La0.8Mg0.15Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.05	7440-48-4
Sr	0.2	7440-24-6
Mg	0.15	7439-95-4
La	0.8	7439-91-0

L62 ANSWER 5 OF 10 HCA COPYRIGHT 2004 ACS on STN
134:181075 Solid oxide **fuel cells.** Tamai, Yoshitaka;
Kuroda, Kiyoshi; Komata, Norikazu (Mitsubishi Materials Corp., Japan).
Jpn. Kokai Tokkyo Koho JP 2001052722 A2 20010223, 7 pp. (Japanese). N A.
CODEN: JKXXAF. APPLICATION: JP 1999-228446 19990812.
AB The **fuel cells** have M1-xAxGa1-y-zA'yA"zO3-d [M = La, Ce, Pr, Nd, and/or Sm; A = Sr, Ca, and/or Ba; A' = Mg, Al, and/or In; A" = Co, Fe, Ni, and/or Cu; x = 0.05-0.3; yr =0.025-0.29; z =0.01-0.15; 9y+z) =0.035-0.3; and d =0.04-0.3] electrolyte layers, M'1-x'Srx'Co1-y'Xy'O3-d' (M' = La and/or Sm, X = Fe and/or Cu, x' = 0.05-0.8, yr' = 0-0.9, d' =0.04-0.3) cathode layers, and an intermediate layer between the 2. The intermediate layer is preferably M1-x-pAxSmpGa1-y-z-qA'yA"zCoqO3-d [p = 0-0.2, q = 0-0.1, and (p+q) =0.01-0.3].
IC ICM H01M008-02
ICS C01G051-00; H01M004-86; H01M008-12
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
ST solid **electrolyte fuel cell** cathode
electrolyte intermediate layer
IT **Solid state fuel cells**
(**solid electrolyte fuel cells**
containing intermediate layers between electrolyte and cathode layers)
IT **220697-02-9D**, oxygen deficit
RL: DEV (Device component use); USES (Uses)
(intermediate layers between electrolyte and cathode layers in solid
electrolyte fuel cells)
IT 59989-70-7D, Cobalt samarium strontium oxide (Co2SmSrO6), oxygen deficit
220697-02-9 326923-61-9D, oxygen deficit
RL: DEV (Device component use); USES (Uses)
(solid **electrolyte fuel cells** containing
intermediate layers between electrolyte and cathode layers)
IT **220697-02-9D**, oxygen deficit
RL: DEV (Device component use); USES (Uses)
(intermediate layers between electrolyte and cathode layers in solid
electrolyte fuel cells)
RN 220697-02-9 HCA
CN Cobalt gallium lanthanum magnesium strontium oxide
(Co0.05Ga0.8La0.8Mg0.15Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.05	7440-48-4
Sr	0.2	7440-24-6
Mg	0.15	7439-95-4
La	0.8	7439-91-0

IT **220697-02-9**
RL: DEV (Device component use); USES (Uses)
(solid **electrolyte fuel cells** containing intermediate layers between electrolyte and cathode layers)
RN 220697-02-9 HCA
CN Cobalt gallium lanthanum magnesium strontium oxide (Co0.05Ga0.8La0.8Mg0.15Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.05	7440-48-4
Sr	0.2	7440-24-6
Mg	0.15	7439-95-4
La	0.8	7439-91-0

L62 ANSWER 6 OF 10 HCA COPYRIGHT 2004 ACS on STN
133:246054 Oxide **ion conductors** and manufacturing conductors thereof. Kuroda, Kiyoshi; Tamai, Yoshitaka; Tanaka, Kazunori; Komada, Norikazu (Mitsubishi Materials Corp., Japan). Jpn. Kokai Tokkyo Koho JP 2000251535 A2 **20000914**, 9 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1999-49667 19990226.
AB The title conductors are Ln1-xAxGa1-y-zB1yB2zO3-d (Ln = La, Ce, Pr, Nd, Sm; A = Sr, Ca, Ba; B1 = Mg, Al, In; B2 = Co, Fe, Ni, Cu; x =0.05-0.3; y = 0.025-0.29; z = 0.01-0.15; (y+z) =0.035-0.3, d =0.04-0.3) which consists of ≥30 volume% crystal grain size 0.25-2.0 μm which is packed among larger-size remainder crystal grains. The oxide **conductors** provides high **ion conductivity** in an wire temperature range without decrease of elec. conductivity
IC ICM H01B001-08
ICS B01D053-22; B01D071-02; G01N027-409; H01M008-02
CC 76-2 (Electric Phenomena)
Section cross-reference(s): **57**, 72
ST lanthanum strontium gallium magnesium cobalt oxide **ion conductor**
IT Electric **conductivity**
Ionic conductivity
Ionic conductors
(oxide **ion conductors** and manufacturing conductors thereof)
IT **220697-02-9DP**, Cobalt gallium lanthanum magnesium strontium oxide (Co0.05Ga0.8La0.8Mg0.15Sr0.2O3), oxygen-deficient 293736-68-2DP, oxygen-deficient
RL: DEV (Device component use); PEP (Physical, engineering or chemical

process); PNU (Preparation, unclassified); PRP (Properties); PREP (Preparation); PROC (Process); USES (Uses)
(**ionic conductor**; oxide **ion conductors** and manufacturing conductors thereof)

IT **220697-02-9DP**, Cobalt gallium lanthanum magnesium strontium oxide (Co0.05Ga0.8La0.8Mg0.15Sr0.2O3), oxygen-deficient
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PNU (Preparation, unclassified); PRP (Properties); PREP (Preparation); PROC (Process); USES (Uses)
(**ionic conductor**; oxide **ion conductors** and manufacturing conductors thereof)

RN 220697-02-9 HCA

CN Cobalt gallium lanthanum magnesium strontium oxide (Co0.05Ga0.8La0.8Mg0.15Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.05	7440-48-4
Sr	0.2	7440-24-6
Mg	0.15	7439-95-4
La	0.8	7439-91-0

L62 ANSWER 7 OF 10 HCA COPYRIGHT 2004 ACS on STN

133:246053 Oxide **ion conductors**, manufacturing, and uses of conductors thereof. Yamada, Ikiko; Adachi, Kazunori; Akikusa, Osamu; Komata, Norikazu (Mitsubishi Materials Corp., Japan). Jpn. Kokai Tokkyo Koho JP 2000251534 A2 **20000914**, 9 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1999-49318 19990226.

AB The title conductors are Ln1-xSrxGa1-(y+z)MgyCozO3 (Ln = La, Nd; x = 0.01-0.3, y =0-0.29, z =0.01-0.3, yr+z =0.025) and are manufactured with powdered
Co3O4 and optionally mixed with CoO. The title conductors are applicable to air electrodes, gas sensors, oxygen separator membranes, and gas separator membranes.

IC ICM H01B001-08
ICS B01D053-22; C01G051-00; G01N027-409; H01M008-02

CC 76-2 (Electric Phenomena)
Section cross-reference(s): 47, 52, **57**, 72

ST lanthanum gallium strontium cobalt magnesium oxide **ionic conductor**; neodymium gallium strontium cobalt magnesium oxide **ionic conductor**; air electrode gas oxygen sepn membrane **ion conductor**

IT Electrodes
(air; oxide **ion conductors**, manufacturing, and uses of conductors thereof)

IT Membranes, nonbiological
(gas, oxygen; oxide **ion conductors**, manufacturing, and uses of conductors thereof)

IT Gas sensors
Ionic conductivity
(oxide **ion conductors**, manufacturing, and uses of conductors thereof)

IT **Ionic conductors**
Sintering

(oxides; oxide **ion conductors**, manufacturing, and uses of conductors thereof)

IT **220697-02-9P**, Cobalt gallium lanthanum magnesium strontium oxide Co0.05Ga0.8La0.8Mg0.15Sr0.2O3
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PNU (Preparation, unclassified); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); PROC (Process); USES (Uses)
(oxide **ion conductors**, manufacturing, and uses of conductors thereof)

IT 1307-96-6, Cobaltous oxide, reactions 1308-06-1, Cobalt oxide (Co3O4)
RL: RCT (Reactant); RACT (Reactant or reagent)
(oxide **ion conductors**, manufacturing, and uses of conductors thereof)

IT **220697-02-9P**, Cobalt gallium lanthanum magnesium strontium oxide Co0.05Ga0.8La0.8Mg0.15Sr0.2O3
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PNU (Preparation, unclassified); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); PROC (Process); USES (Uses)
(oxide **ion conductors**, manufacturing, and uses of conductors thereof)

RN 220697-02-9 HCA
CN Cobalt gallium lanthanum magnesium strontium oxide (Co0.05Ga0.8La0.8Mg0.15Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.05	7440-48-4
Sr	0.2	7440-24-6
Mg	0.15	7439-95-4
La	0.8	7439-91-0

=> d L64 1-6 cbib abs hitind hitstr

L64 ANSWER 1 OF 6 HCA COPYRIGHT 2004 ACS on STN
134:134143 Structures and fabrication techniques for **solid state** electrochemical devices. Visco, Steven J.; Jacobson, Craig P.; Dejonghe, Lutgard C. (The Regents of the University of California, USA). PCT Int. Appl. WO 2001009968 A1 20010208, 45 pp. DESIGNATED STATES: W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG. (English). CODEN: PIXXD2. APPLICATION: WO 2000-US20889 20000728. PRIORITY: US 1999-PV146769 19990731.

AB Provided are low-cost, mech. strong, highly electronically conductive porous substrates and associated structures for **solid-state** electrochem. devices, techniques for forming these structures, and devices incorporating the structures. The invention provides **solid**

state electrochem. device substrates of novel composition and techniques for forming thin electrode/membrane/electrolyte coatings on the novel or more conventional substrates. In particular, in one embodiment the invention provides techniques for co-firing of device substrate (often an electrode) with an electrolyte or membrane layer to form densified electrolyte/membrane films 5 to 20 μm thick. In another embodiment, densified electrolyte/membrane films 5 to 20 μm thick may be formed on a pre-sintered substrate by a constrained sintering process. In some cases, the substrate may be a porous metal, alloy, or non-nickel cermet incorporating one or more of the transition metals Cr, Fe, Cu and Ag, or alloys thereof.

IC H01M008-00

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 55, **57**, 72

ST electrochem device **solid state; fuel cell solid state**

IT Coating process
(dip; structures and fabrication techniques for **solid state** electrochem. devices)

IT Catalysts
(electrocatalysts; structures and fabrication techniques for **solid state** electrochem. devices)

IT Electric apparatus
(electrochem.; structures and fabrication techniques for **solid state** electrochem. devices)

IT Electric **conductors**
(mixed, electronic-**ionic**; structures and fabrication techniques for **solid state** electrochem. devices)

IT Transition metal alloys
Transition metals, uses
RL: TEM (Technical or engineered material use); USES (Uses)
(non-noble, substrate; structures and fabrication techniques for **solid state** electrochem. devices)

IT Coating process
(spray, aerosol; structures and fabrication techniques for **solid state** electrochem. devices)

IT **Ceramic** coatings
Electrophoretic deposition
Ionic conductors
Sintering
Solid state fuel cells
Thermal expansion
(structures and fabrication techniques for **solid state** electrochem. devices)

IT Cermets
(substrate; structures and fabrication techniques for **solid state** electrochem. devices)

IT Molding
(tape-casting; structures and fabrication techniques for **solid state** electrochem. devices)

IT Diffusion
(vacuum; structures and fabrication techniques for **solid state** electrochem. devices)

IT 25805-17-8, XUS 40303.00
RL: TEM (Technical or engineered material use); USES (Uses)
(binder; structures and fabrication techniques for **solid state** electrochem. devices)

IT 12036-39-4, Strontium zirconium oxide srzro3 12267-77-5, Barium cerium

oxide baceo3 12267-97-9, Cerium strontium oxide cesro3
RL: TEM (Technical or engineered material use); USES (Uses)
(doped; structures and fabrication techniques for **solid state** electrochem. devices)

IT 12597-69-2, Steel, uses
RL: TEM (Technical or engineered material use); USES (Uses)
(ferritic, substrate; structures and fabrication techniques for **solid state** electrochem. devices)

IT 112721-99-0
RL: DEV (Device component use); USES (Uses)
(structures and fabrication techniques for **solid state** electrochem. devices)

IT 1333-74-0P, Hydrogen, preparation
RL: SPN (Synthetic preparation); PREP (Preparation)
(structures and fabrication techniques for **solid state** electrochem. devices)

IT 222613-26-5, Cobalt iron strontium oxide Co0.75Fe0.25SrO3
RL: TEM (Technical or engineered material use); USES (Uses)
(structures and fabrication techniques for **solid state** electrochem. devices)

IT 11109-52-7, AISI 430 12611-79-9, AISI 410 39418-83-2, AISI 409
RL: TEM (Technical or engineered material use); USES (Uses)
(substrate, composite with **ceramic**; structures and fabrication techniques for **solid state** electrochem. devices)

IT 1344-28-1, Alumina, uses 7439-89-6, Iron, uses 7440-02-0, Nickel, uses 7440-22-4, Silver, uses 7440-47-3, Chromium, uses 7440-50-8, Copper, uses 11078-74-3, Bismuth yttrium oxide (Bi3YO6) 12606-02-9, Inconel 600 59989-70-7D, Cobalt samarium strontium oxide CoSm0.5Sr0.5O3, oxygen-deficient 64417-98-7, Yttrium zirconium oxide 106830-29-9, Yttrium zirconium oxide Y0.2Zr0.9O2.1 108916-22-9D, Lanthanum manganese strontium oxide La0.8MnSr0.2O3, oxygen-deficient 111569-09-6, Scandium zirconium oxide 114168-16-0, Tz-8y 116036-94-3D, Iron lanthanum nickel oxide Fe0.4LaNi0.6O3, oxygen-deficient 141588-91-2D, Lanthanum manganese strontium oxide La0.45MnSr0.55O3, oxygen-deficient 157975-55-8D, Lanthanum manganese strontium oxide La0.65MnSr0.3O3, oxygen-deficient 181530-05-2D, Cobalt iron lanthanum strontium oxide Co0.6Fe0.4La0.6Sr0.4O3, oxygen-deficient 197160-34-2, Cerium gadolinium oxide Ce0.8Gd0.4O2.2 235428-75-8D, Cerium manganese strontium oxide Ce0.3MnSr0.7O3, oxygen-deficient **252913-17-0**, Gallium lanthanum magnesium strontium oxide Ga0.85La0.8Mg0.15Sr0.2O2.8 321909-12-0D, Lanthanum manganese strontium oxide (La0-0.95Mn0.95-1.15Sr0.05-1O3), oxygen-deficient 321909-14-2D, Cobalt lanthanum strontium oxide (CoLa0-0.9Sr0.1-1O3), oxygen-deficient 321909-15-3D, Cobalt iron strontium oxide (Co0.7-0.8Fe0.2-0.3SrO3), oxygen-deficient 321981-55-9, Cr5Fe1Y
RL: TEM (Technical or engineered material use); USES (Uses)
(substrate; structures and fabrication techniques for **solid state** electrochem. devices)

IT 1314-23-4, Zirconia, uses
RL: TEM (Technical or engineered material use); USES (Uses)
(yttria-stabilized, substrate; structures and fabrication techniques for **solid state** electrochem. devices)

IT 1314-36-9, Yttria, uses 12060-08-1, Scandia
RL: TEM (Technical or engineered material use); USES (Uses)
(zirconia stabilized with, substrate; structures and fabrication techniques for **solid state** electrochem. devices)

IT **252913-17-0**, Gallium lanthanum magnesium strontium oxide

Ga0.85La0.8Mg0.15Sr0.2O2.8
RL: TEM (Technical or engineered material use); USES (Uses)
(substrate; structures and fabrication techniques for **solid state** electrochem. devices)

RN 252913-17-0 HCA

CN Gallium lanthanum magnesium strontium oxide (Ga0.85La0.8Mg0.15Sr0.2O2.8) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	2.8	17778-80-2
Ga	0.85	7440-55-3
Sr	0.2	7440-24-6
Mg	0.15	7439-95-4
La	0.8	7439-91-0

L64 ANSWER 2 OF 6 HCA COPYRIGHT 2004 ACS on STN

134:44452 Interface reactions in the NiO-SDC-LSGM system. Zhang, Xinge; Ohara, Satoshi; Maric, Radenka; Okawa, Hajime; Fukui, Takehisa; Yoshida, Hiroyuki; Inagaki, Toru; Miura, Kazuhiro (Japan Fine Ceramics Center, Nagoya, 456-8587, Japan). Solid State Ionics, 133(3,4), 153-160 (English) **2000**. CODEN: SSIOD3. ISSN: 0167-2738. Publisher: Elsevier Science B.V..

AB The reactivity of NiO-SDC (samaria-doped ceria) anode material with a Sr- and Mg-doped lanthanum gallate (LSGM) electrolyte was studied by X-ray diffraction (XRD) and elec. measurements. It was found that a LaNiO3-based compound in hexagonal structure formed in binary powder mixts. of NiO and LSGM after firing at 1150°C. Reaction between SDC and LSGM was also observed Several SDC peaks merged with the adjacent LSGM peaks during firing, and a SrLaGa3O7 compound was identified as a reaction product. Reaction between LSGM and SDC could cause more than 50% loss in the **ionic conductivity** of LSGM-SDC electrolytes sintered at 1350°C. The measured conductivity of an LSGM electrolyte with a NiO-LSGM anode prepared at 1350°C was extremely low, indicating that the LaNiO3-based new phase is highly insulating. The reaction between NiO and SDC was not so obvious in comparison with NiO-LSGM and SDC-LSGM binary mixts.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): **57**, 72

ST **fuel cell** anode **electrolyte** reactivity;
nickel oxide samaria doped ceria anode; lanthanum gallate electrolyte

IT **Fuel cell** anodes
Fuel cell electrolytes
Ionic conductivity
Solid state fuel cells
(interface reactions in the NiO-samaria-doped ceria anode/strontium- and magnesium-doped lanthanum gallate electrolyte system)

IT 1313-99-1, Nickel oxide (NiO), uses 12031-18-4, Lanthanum nickel oxide (LaNiO3) 116875-84-4, Cerium samarium oxide ce0.8sm0.2o1.9
155343-26-3, Gallium lanthanum magnesium strontium oxide ga0.8la0.9mg0.2sr0.1o3
RL: DEV (Device component use); USES (Uses)
(interface reactions in the NiO-samaria-doped ceria anode/strontium- and magnesium-doped lanthanum gallate electrolyte system)

IT **155343-26-3**, Gallium lanthanum magnesium strontium oxide ga0.8la0.9mg0.2sr0.1o3

RL: DEV (Device component use); USES (Uses)
(interface reactions in the NiO-samaria-doped ceria anode/strontium- and magnesium-doped lanthanum gallate electrolyte system)

RN 155343-26-3 HCA

CN Gallium lanthanum magnesium strontium oxide (Ga0.8La0.9Mg0.2Sr0.1O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Sr	0.1	7440-24-6
Mg	0.2	7439-95-4
La	0.9	7439-91-0

L64 ANSWER 3 OF 6 HCA COPYRIGHT 2004 ACS on STN

132:316622 Mixed oxide solid oxygen **ion conductors.**
Yamamura, Hiroshi; Kakinuma, Katsuyoshi; Ikegaki, Tetsuo (Tosoh Corp., Japan). Jpn. Kokai Tokkyo Koho JP 2000128636 A2 **20000509**, 4 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1998-300159 19981021.

AB The conductor is mixed oxide containing Ba and In, with its Ba partially substituted with La. Optionally, In may partially be substituted with Ga. Preferably, the conductors have conductivity ≥10-2 S/cm at 800° and ≥10-3 S/cm at 600°. The conductors are especially useful for solid oxide **fuel cells** and oxygen sensors.

IC ICM C04B035-495
ICS C01G015-00; G01N027-409; H01B001-08; H01M008-02

CC 76-2 (Electric Phenomena)
Section cross-reference(s): 57

ST barium indium lanthanum oxide **ion conductor;** gallium barium indium lanthanum oxide conductor; oxygen **ion conductor** mixed oxide

IT Electric conductors, **ceramic**
(barium indium lanthanum oxide oxygen **ion conductors** having excellent low-temperature conductor characteristics)

IT 186610-35-5P, Barium indium lanthanum oxide (Ba1.4In2La0.6O5.3) 254879-39-5P, Barium indium lanthanum oxide (BaIn2LaO5.5) **265096-39-7P,** Barium gallium indium lanthanum oxide (Ba1.8GaInLa0.2O5.1) **265096-40-0P,** Barium gallium indium lanthanum oxide (Ba1.4GaInLa0.6O5.3) **265096-41-1P,** Barium gallium indium lanthanum oxide (BaGaInLaO5.5)
RL: PNU (Preparation, unclassified); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
(barium indium lanthanum oxide oxygen **ion conductors** having excellent low-temperature conductor characteristics)

IT **265096-39-7P,** Barium gallium indium lanthanum oxide (Ba1.8GaInLa0.2O5.1) **265096-40-0P,** Barium gallium indium lanthanum oxide (Ba1.4GaInLa0.6O5.3) **265096-41-1P,** Barium gallium indium lanthanum oxide (BaGaInLaO5.5)
RL: PNU (Preparation, unclassified); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
(barium indium lanthanum oxide oxygen **ion conductors** having excellent low-temperature conductor characteristics)

RN 265096-39-7 HCA

CN Barium gallium indium lanthanum oxide (Ba1.8GaInLa0.2O5.1) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	5.1	17778-80-2
In	1	7440-74-6
Ga	1	7440-55-3
Ba	1.8	7440-39-3
La	0.2	7439-91-0

RN 265096-40-0 HCA
CN Barium gallium indium lanthanum oxide (Ba1.4GaInLa0.6O5.3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	5.3	17778-80-2
In	1	7440-74-6
Ga	1	7440-55-3
Ba	1.4	7440-39-3
La	0.6	7439-91-0

RN 265096-41-1 HCA
CN Barium gallium indium lanthanum oxide (BaGaInLaO5.5) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	5.5	17778-80-2
In	1	7440-74-6
Ga	1	7440-55-3
Ba	1	7440-39-3
La	1	7439-91-0

L64 ANSWER 4 OF 6 HCA COPYRIGHT 2004 ACS on STN
132:267541 Intermediate temperature solid oxide **fuel cells** using LaGaO3 **electrolyte** II. Improvement of oxide **ion conductivity** and power density by doping Fe for Ga site of LaGaO3. Ishihara, Tatsumi; Shibayama, Takaaki; Honda, Miho; Nishiguchi, Hiroyasu; Takita, Yusaku (Department of Applied Chemistry, Faculty of Engineering, Oita University, Oita, 870-1192, Japan). Journal of the Electrochemical Society, 147(4), 1332-1337 (English) **2000**. CODEN: JESOAN. ISSN: 0013-4651. Publisher: Electrochemical Society.

AB Effects of small amts. of Fe doping for Ga site in LaGaO3-based oxide on oxide **ion conductivity** is investigated in this study. It is found that doping a small amount of Fe is effective for improving the oxide **ion conductivity** in La0.8Sr0.2Ga0.8Mg0.2O3 (LSGM). The highest oxide **ion conductivity** was exhibited at x = 0.03 in La0.8Sr0.2Ga0.8Mg0.2-xFexO3 among the Fe-doped samples. ESR (ESR) measurements suggest that Fe is trivalent in LaGaO3 lattice. The application of the Fe-doped LaGaO3-based oxide for the electrolyte of solid oxide **fuel cell** was further investigated. Power d. of the solid oxide **fuel cell** was increased by using Fe-doped LSGM for electrolyte. This can be explained by the decrease in elec. resistance loss by improving the oxide **ion conductivity**

A maximum power d. close to 700 mW/cm2 was obtained at 1073 K on the cell using 0.5 mm thick La0.8Sr0.2Ga0.8Mg0.17Fe0.03O3 (LSGMF) and O2 as the electrolyte and the oxidant, resp. Therefore, close to the theor. open-circuit potential was exhibited by the LSGMF cell. On the other hand, the power d. was slightly smaller than that of the cell using Co-doped LSGM as electrolyte, especially, at temps. lower than 973 K. This may result from the large activation energy for **ion conductivity** However, the power d. of the LSGMF cell was higher than that of the LSGM cell. Therefore, LSGM doped with a small amount of Fe is a promising electrolyte similar to Co-doped LSGM for the intermediate solid oxide **fuel cell**.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 57, 72, 76

ST solid oxide **fuel cell electrolyte**; lanthanum gallate iron doped electrolyte

IT Crystal structure
Fuel cell electrolytes
Ionic conductivity
Solid state fuel cells
(intermediate temperature solid oxide **fuel cells** using LaGaO3 **electrolyte** with improved conductivity and power d. by doping Fe for Ga site)

IT 12160-53-1, Gallium lanthanum oxide (GaLaO3) **12183-33-4**, Gallium Lanthanum strontium oxide galasro4 59989-70-7, Cobalt samarium strontium oxide cosm0.5sr0.5o3 **165900-07-2**, Gallium Lanthanum magnesium strontium oxide ga0.8la0.8mg0.2sr0.2o3 **203735-99-3** **220667-93-6** **220668-20-2** **220668-22-4** **220668-23-5**
RL: DEV (Device component use); USES (Uses)
(intermediate temperature solid oxide **fuel cells** using LaGaO3 **electrolyte** with improved conductivity and power d. by doping Fe for Ga site)

IT **12183-33-4**, Gallium Lanthanum strontium oxide galasro4 **165900-07-2**, Gallium Lanthanum magnesium strontium oxide ga0.8la0.8mg0.2sr0.2o3 **203735-99-3** **220667-93-6** **220668-20-2** **220668-22-4** **220668-23-5**
RL: DEV (Device component use); USES (Uses)
(intermediate temperature solid oxide **fuel cells** using LaGaO3 **electrolyte** with improved conductivity and power d. by doping Fe for Ga site)

RN 12183-33-4 HCA
CN Gallium lanthanum strontium oxide (GaLaSrO4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ga	1	7440-55-3
Sr	1	7440-24-6
La	1	7439-91-0

RN 165900-07-2 HCA
CN Gallium lanthanum magnesium strontium oxide (Ga0.8La0.8Mg0.2Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number

O	3	17778-80-2
Ga	0.8	7440-55-3
Sr	0.2	7440-24-6
Mg	0.2	7439-95-4
La	0.8	7439-91-0

RN 203735-99-3 HCA
CN Gallium iron lanthanum magnesium strontium oxide (Ga0.8Fe0.1La0.8Mg0.1Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Sr	0.2	7440-24-6
Mg	0.1	7439-95-4
La	0.8	7439-91-0
Fe	0.1	7439-89-6

RN 220667-93-6 HCA
CN Cobalt gallium lanthanum magnesium strontium oxide (Co0.08Ga0.8La0.8Mg0.12Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.08	7440-48-4
Sr	0.2	7440-24-6
Mg	0.12	7439-95-4
La	0.8	7439-91-0

RN 220668-20-2 HCA
CN Gallium iron lanthanum magnesium strontium oxide (Ga0.8Fe0.03La0.8Mg0.17Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Sr	0.2	7440-24-6
Mg	0.17	7439-95-4
La	0.8	7439-91-0
Fe	0.03	7439-89-6

RN 220668-22-4 HCA
CN Gallium iron lanthanum magnesium strontium oxide (Ga0.8Fe0.05La0.8Mg0.15Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Sr	0.2	7440-24-6

Mg	0.15	7439-95-4
La	0.8	7439-91-0
Fe	0.05	7439-89-6

RN 220668-23-5 HCA
CN Gallium iron lanthanum magnesium strontium oxide
(Ga0.8Fe0.15La0.8Mg0.05Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Sr	0.2	7440-24-6
Mg	0.05	7439-95-4
La	0.8	7439-91-0
Fe	0.15	7439-89-6

L64 ANSWER 5 OF 6 HCA COPYRIGHT 2004 ACS on STN
132:126443 Oxygen **ion conductivity** and power density of LaGaO3 alternative electrolytes for **ceramic fuel cell**. Choi, Soon Mok; Lee, Ki Tae; Kim, Ki Young; Kim, Shin; Lee, Hong Lim (Department of Ceramic Engineering, Yonsei University, Seoul, 120-749, S. Korea). Yoop Hakhoechi, 36(9), 909-914 (Korean) **1999** . CODEN: YPHJAP. ISSN: 0372-7807. Publisher: Korean Ceramic Society.

AB La0.9Ba0.1Ga0.8Mg0.2O2.85, an alternative electrolyte candidate of **ceramic fuel cell**, exhibited very high oxygen **ion conductivity** of > 0.1 S/cm at 800°C. The maximum power d. of the single cell of Ni anode/La0.9Ba0.1Ga0.8Mg0.2O2.85/Sm0.5Sr0.5CoO3-δ cathode system was measured as 0.15 W/cm2 at 1000°C.

CC **57-2** (Ceramics)
Section cross-reference(s): 52, 76

ST lanthanum gallate solid electrolyte property **ceramic fuel cell**

IT **Fuel cells**
(**ceramic**; oxygen **ion conductivity** and power d. of LaGaO3 solid electrolyte for **ceramic fuel cell**)

IT Solid electrolytes
(lanthanum gallate; oxygen **ion conductivity** and power d. of LaGaO3 solid electrolyte for **ceramic fuel cell**)

IT **Ionic conductivity**
(oxygen **ion conductivity** and power d. of LaGaO3 solid electrolyte for **ceramic fuel cell**)

IT 7440-02-0, Nickel, processes
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PRP (Properties); PROC (Process); USES (Uses)
(anode, **fuel cell**; oxygen **ion conductivity** and power d. of LaGaO3 solid electrolyte for **ceramic fuel cell**)

IT 59989-70-7D, Cobalt samarium strontium oxide CoSm0.5Sr0.5O3, oxygen-deficient
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PRP (Properties); PROC (Process); USES (Uses)
(cathode, **fuel cell**; oxygen **ion conductivity** and power d. of LaGaO3 solid electrolyte for

ceramic fuel cell)
IT **256369-55-8**, Barium gallium lanthanum magnesium oxide (Ba0.1Ga0.8La0.9Mg0.2O2.85)
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PRP (Properties); PROC (Process); USES (Uses)
(**electrolyte, fuel cell**; oxygen
ion conductivity and power d. of LaGaO3 solid electrolyte
for **ceramic fuel cell**)
IT **256369-55-8**, Barium gallium lanthanum magnesium oxide (Ba0.1Ga0.8La0.9Mg0.2O2.85)
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PRP (Properties); PROC (Process); USES (Uses)
(**electrolyte, fuel cell**; oxygen
ion conductivity and power d. of LaGaO3 solid electrolyte
for **ceramic fuel cell**)
RN 256369-55-8 HCA
CN Barium gallium lanthanum magnesium oxide (Ba0.1Ga0.8La0.9Mg0.2O2.85) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	2.85	17778-80-2
Ga	0.8	7440-55-3
Ba	0.1	7440-39-3
Mg	0.2	7439-95-4
La	0.9	7439-91-0

L64 ANSWER 6 OF 6 HCA COPYRIGHT 2004 ACS on STN
131:34657 Structure and conducting properties of La1-xSrxCoO3-δ films.
Chen, X.; Wu, N. J.; Ignatiev, A. (Space Vacuum Epitaxy Center and Texas Center for Superconductivity, University of Houston, Houston, TX, 77024-5507, USA). Journal of the European Ceramic Society, 19(6-7), 819-822 (English) **1999**. CODEN: JECSER. ISSN: 0955-2219.
Publisher: Elsevier Science Ltd..
AB La1-xSrxCoO3-δ (LSCO) films have been deposited on LaAlO3 (LAO), La1-δSrxGa1-yMgyO3-δ/LaAlO3 (LSGM/LAO) and yttria-stabilized zirconia (YSZ) substrates by pulsed laser deposition (PLD) for application to thin film solid oxide **fuel cell** cathodes. The optimum conditions for deposition were determined for the different substrates in an ambient of 80-310 mtorr oxygen pressure and at a substrate temperature range of 450 to 750 °C. The films structures were analyzed by XRD, RBS and SEM. Epitaxial LSCO films were grown with (110) preferred orientation on YSZ, and with (100) orientation on LAO and LSGM/LAO. The elec. resistivity of the epitaxial LSCO films ranged from 10-2 to 10-4 Ω cm, depending on the deposition temperature and substrate. The **ionic conducting** behavior of the LSCO film on YSZ was investigated by impedance measurement.
CC **57-2** (Ceramics)
Section cross-reference(s): 52, 76
ST structure elec cond cobalt lanthanum strontium oxide film; **fuel cell** cathode cobalt lanthanum strontium oxide film; orientation cobalt lanthanum strontium oxide film pulsed laser deposition
IT Films
Films
(**ceramic**, cobalt lanthanum strontium oxide; structure and conducting properties of La1-xSrxCoO3-δ films deposited on

ceramic substrates by pulsed laser deposition for use as
fuel cell cathodes)

IT **Ceramics**
Ceramics
(films, cobalt lanthanum strontium oxide; structure and conducting properties of La1-xSrxCoO3-δ films deposited on **ceramic** substrates by pulsed laser deposition for use as **fuel cell** cathodes)

IT Vapor deposition process
(pulsed laser; structure and conducting properties of La1-xSrxCoO3-δ films deposited on **ceramic** substrates by pulsed laser deposition for use as **fuel cell** cathodes)

IT Crystal orientation
Electric resistance
Epitaxy
Fuel cell cathodes
Ionic conductivity
(structure and conducting properties of La1-xSrxCoO3-δ films deposited on **ceramic** substrates by pulsed laser deposition for use as **fuel cell** cathodes)

IT **Ceramics**
(substrates; structure and conducting properties of La1-xSrxCoO3-δ films deposited on **ceramic** substrates by pulsed laser deposition for use as **fuel cell** cathodes)

IT 108729-85-7D, Cobalt lanthanum strontium oxide (CoLa0-1Sr0-1O3), oxygen-deficient
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PRP (Properties); PROC (Process); USES (Uses)
(films; structure and conducting properties of La1-xSrxCoO3-δ films deposited on **ceramic** substrates by pulsed laser deposition for use as **fuel cell** cathodes)

IT 12003-65-5, Aluminum lanthanum oxide (AlLaO3) 64417-98-7, Yttrium zirconium oxide
RL: TEM (Technical or engineered material use); USES (Uses)
(substrate; structure and conducting properties of La1-xSrxCoO3-δ films deposited on **ceramic** substrates by pulsed laser deposition for use as **fuel cell** cathodes)

IT **208116-16-9**, Gallium lanthanum magnesium strontium oxide
RL: TEM (Technical or engineered material use); USES (Uses)
(substrates; structure and conducting properties of La1-xSrxCoO3-δ films deposited on **ceramic** substrates by pulsed laser deposition for use as **fuel cell** cathodes)

IT 1314-23-4, Zirconia, uses
RL: TEM (Technical or engineered material use); USES (Uses)
(yttria-stabilized, substrate; structure and conducting properties of La1-xSrxCoO3-δ films deposited on **ceramic** substrates by pulsed laser deposition for use as **fuel cell** cathodes)

IT 1314-36-9, Yttria, uses
RL: TEM (Technical or engineered material use); USES (Uses)
(zirconia stabilized by, substrate; structure and conducting properties of La1-xSrxCoO3-δ films deposited on **ceramic** substrates by pulsed laser deposition for use as **fuel cell** cathodes)

IT **208116-16-9**, Gallium lanthanum magnesium strontium oxide

RL: TEM (Technical or engineered material use); USES (Uses)
(substrates; structure and conducting properties of
La1-xSrxCoO3-δ films deposited on **ceramic** substrates by
pulsed laser deposition for use as **fuel cell**
cathodes)

RN 208116-16-9 HCA

CN Gallium lanthanum magnesium strontium oxide (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	x	17778-80-2
Ga	x	7440-55-3
Sr	x	7440-24-6
Mg	x	7439-95-4
La	x	7439-91-0

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L88 ANSWER 1 OF 3 HCA COPYRIGHT 2004 ACS on STN

138:172788 Oxygen ion conducting materials. Vaughey, John; Krumpelt, Michael; Wang, Xiaoping; Carter, J. David (University of Chicago, USA). U.S. US 6521202 B1 20030218, 6 pp. (English). CODEN: USXXAM. APPLICATION: US 1999-344859 19990628.

AB An oxygen ion conducting **ceramic** oxide that has applications in industry including **fuel cells, oxygen pumps, oxygen sensors,** and separation membranes. The material is based on the idea that substituting a dopant into the host **perovskite** lattice of (La,Sr)MnO3 that prefers a coordination number lower than 6 will induce oxygen ion vacancies to form in the lattice. Because the oxygen ion conductivity of (La,Sr)MnO3 is low over a large temperature range, the material exhibits a high overpotential when used. The inclusion of oxygen vacancies into the lattice by doping the material was found to maintain the desirable properties of (La,Sr)MnO3, while significantly decreasing the exptl. observed overpotential. The material is especially suitable for solid oxide **fuel cell** cathodes.

IC ICM C01G045-12
ICS B01J023-00; B01J023-32; H01M004-50; H01M004-42

NCL 423599000; 502303000; 502324000; 429220000; 429223000; 429224000; 429229000

CC 49-4 (Industrial Inorganic Chemicals)
Section cross-reference(s): 52

ST doped **perovskite** oxygen ion conductor

IT **Fuel cells**
Perovskite-type crystals
(oxygen ion conducting materials based on doped **perovskite**
which are suitable for solid oxide **fuel cell**
cathodes, oxygen **sensors,** and separation membranes)

IT Gas **sensors**
Pumps
(**oxygen; oxygen** ion conducting materials based on
doped **perovskite** which are suitable for solid oxide
fuel cell cathodes, oxygen **sensors,** and
separation membranes)

IT Membranes, nonbiological

(separation; oxygen ion conducting materials based on doped **perovskite** which are suitable for solid oxide **fuel cell** cathodes, oxygen **sensors,** and separation membranes)

IT **Fuel cell** cathodes
(solid oxide; oxygen ion conducting materials based on doped **perovskite** which are suitable for solid oxide **fuel cell** cathodes, oxygen **sensors,** and separation membranes)

IT 7440-24-6, Strontium, uses 7440-70-2, Calcium, uses
RL: MOA (Modifier or additive use); USES (Uses)
(dopant for lanthanum; oxygen ion conducting materials based on doped **perovskite** which are suitable for solid oxide **fuel cell** cathodes, oxygen **sensors,** and separation membranes)

IT 7429-90-5, Aluminum, uses 7440-02-0, Nickel, uses 7440-50-8, Copper, uses 7440-55-3, Gallium, uses 7440-66-6, Zinc, uses
RL: MOA (Modifier or additive use); USES (Uses)
(dopant for manganese; oxygen ion conducting materials based on doped **perovskite** which are suitable for solid oxide **fuel cell** cathodes, oxygen **sensors,** and separation membranes)

IT 12031-12-8, Lanthanum **manganese oxide** (LaMnO3)
124607-16-5, Lanthanum manganese strontium oxide (La0.79MnSr0.2O3)
497221-32-6, Lanthanum manganese strontium oxide (La0.54MnSr0.45O3)
497221-33-7, Lanthanum manganese strontium oxide (La0.59MnSr0.4O3)
497221-34-8D, oxygen-deficient
RL: TEM (Technical or engineered material use); USES (Uses)
(oxygen ion conducting materials based on doped **perovskite** which are suitable for solid oxide **fuel cell** cathodes, oxygen **sensors,** and separation membranes)

IT **497221-34-8D**, oxygen-deficient
RL: TEM (Technical or engineered material use); USES (Uses)
(oxygen ion conducting materials based on doped **perovskite** which are suitable for solid oxide **fuel cell** cathodes, oxygen **sensors,** and separation membranes)

RN 497221-34-8 HCA
CN Gallium lanthanum manganese strontium oxide (Ga0.05La0.54Mn0.95Sr0.45O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.05	7440-55-3
Sr	0.45	7440-24-6
Mn	0.95	7439-96-5
La	0.54	7439-91-0

L88 ANSWER 2 OF 3 HCA COPYRIGHT 2004 ACS on STN
133:197296 **Perovskite**-type mixed ionic conductor and device therefrom. Taniguchi, Noboru (Matsushita Electric Industrial Co., Ltd., Japan). Eur. Pat. Appl. EP 1029837 A2 **20000823**, 18 pp. NO
DESIGNATED STATES: R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO. (English). CODEN: EPXXDW.
APPLICATION: EP 2000-301251 20000217. PRIORITY: JP 1999-38369 19990217.

AB The mixed ionic conductor with an ion conductive oxide has a **perovskite** structure, e.g. of the formula Baa(Ce1-bM1b)LcO</sen><sen>3-α, where M1 is ≥1 of trivalent rare earth element other than Ce; L is ≥1 of element selected from Zr, Ti, V, Nb, Cr, Mo, W, Fe, Co, Ni, Cu, Ag, Au, Pd, Pt, Bi, Sb, Sn, Pb and

Ga; with $0.9 \le a \le 1$; $0.16 \le b \le 0.26$; 0.01 $\le c \le 0.1$; and $(2+b-2a)/2 \le \alpha \le < 1.5$.
Such a mixed ionic conductor has not only the necessary conductivity for electrochem. devices such as **fuel cells**, but also superior moisture resistance.

IC ICM C04B035-46
ICS H01M008-12; G01N027-12

CC 57-2 (Ceramics)
Section cross-reference(s): 52, 76

ST **perovskite** mixed ionic conductor **fuel cell**

IT **Ceramics**
Fuel cells
Gas **sensors**
Ionic conductors
(**perovskite**-type mixed ionic conductors for **fuel cells** and gas **sensors**)

IT 12194-71-7, **Perovskite** 120805-25-6D, Barium tin zirconium oxide (BaSn0.3Zr0.7O3), oxygen-deficient 140883-54-1D, Barium ytterbium zirconium oxide (BaYb0.05Zr0.95O3), oxygen-deficient 143961-37-9D, Barium yttrium zirconium oxide (BaY0.2Zr0.8O3), oxygen-deficient 144378-46-1D, Barium cerium gadolinium oxide (BaCe0.8Gd0.2O3), oxygen-deficient 176794-69-7D, Barium praseodymium zirconium oxide (BaPr0.05Zr0.95O3), oxygen-deficient 176794-70-0D, Barium tin zirconium oxide (BaSn0.25Zr0.75O3), oxygen-deficient 188016-29-7D, Barium gallium zirconium oxide (BaGa0.2Zr0.8O3), oxygen-deficient 188016-32-2D, Barium indium zirconium oxide (BaIn0.2Zr0.8O3), oxygen-deficient 199537-54-7D, Barium cerium gadolinium oxide (Ba0.9Ce0.8Gd0.2O3), oxygen-deficient 199537-57-0D, Barium cerium gadolinium oxide (Ba0.98Ce0.8Gd0.2O3), oxygen-deficient 288864-49-3D, Barium cerium indium zirconium oxide (BaCe0.6In0.1Zr0.3O3), oxygen-deficient 288864-50-6D, Barium cerium gadolinium oxide (Ba0.94Ce0.8Gd0.2O3), oxygen-deficient 288864-51-7D, Barium cerium gadolinium zirconium oxide (BaCe0.8Gd0.2Zr0.01O3), oxygen-deficient 288864-52-8D, Barium cerium gadolinium zirconium oxide (BaCe0.8Gd0.2Zr0.04O3), oxygen-deficient 288864-53-9D, Barium cerium gadolinium zirconium oxide (BaCe0.8Gd0.2Zr0.06O3), oxygen-deficient 288864-54-0D, Barium cerium gadolinium zirconium oxide (BaCe0.8Gd0.2Zr0.1O3), oxygen-deficient 288864-55-1D, Barium cerium gadolinium zirconium oxide (BaCe0.8Gd0.2Zr0.11O3), oxygen-deficient 288864-56-2D, Barium cerium gadolinium zirconium oxide (BaCe0.8Gd0.2Zr0.15O3), oxygen-deficient 288864-57-3D, Barium cerium gadolinium zirconium oxide (Ba0.99Ce0.8Gd0.2Zr0.01O3), oxygen-deficient 288864-58-4D, Barium cerium gadolinium zirconium oxide (Ba0.99Ce0.8Gd0.2Zr0.04O3), oxygen-deficient 288864-59-5D, Barium cerium gadolinium zirconium oxide (Ba0.99Ce0.8Gd0.2Zr0.06O3), oxygen-deficient 288864-60-8D, Barium cerium gadolinium zirconium oxide (Ba0.99Ce0.8Gd0.2Zr0.1O3), oxygen-deficient 288864-61-9D, Barium cerium gadolinium zirconium oxide (Ba0.99Ce0.8Gd0.2Zr0.11O3), oxygen-deficient 288864-62-0D, Barium cerium gadolinium zirconium oxide (Ba0.98Ce0.8Gd0.2Zr0.01O3), oxygen-deficient 288864-63-1D, Barium cerium gadolinium zirconium oxide (Ba0.98Ce0.8Gd0.2Zr0.04O3), oxygen-deficient 288864-64-2D, Barium cerium gadolinium zirconium oxide (Ba0.98Ce0.8Gd0.2Zr0.06O3), oxygen-deficient 288864-65-3D, Barium cerium gadolinium zirconium oxide (Ba0.98Ce0.8Gd0.2Zr0.1O3), oxygen-deficient 288864-66-4D, Barium cerium gadolinium zirconium oxide (Ba0.98Ce0.8Gd0.2Zr0.11O3), oxygen-deficient 288864-67-5D, Barium cerium gadolinium zirconium oxide (Ba0.9Ce0.8Gd0.2Zr0.01O3), oxygen-deficient 288864-68-6D, Barium cerium gadolinium zirconium oxide (Ba0.9Ce0.8Gd0.2Zr0.04O3), oxygen-deficient 288864-69-7D, Barium cerium

288865-10-1D, Barium cerium gadolinium titanium oxide (Ba0.99Ce0.8Gd0.2Ti0.1O3), oxygen-deficient 288865-11-2D, Barium cerium gadolinium titanium oxide (Ba0.98Ce0.8Gd0.2Ti0.04O3), oxygen-deficient 288865-12-3D, Barium cerium gadolinium titanium oxide (Ba0.9Ce0.8Gd0.2Ti0.1O3), oxygen-deficient 288865-13-4D, Barium cerium gadolinium titanium oxide (Ba0.98Ce0.8Gd0.16Ti0.04O3), oxygen-deficient 288865-14-5D, Barium bismuth cerium gadolinium oxide (Ba0.99Bi0.01Ce0.8Gd0.2O3), oxygen-deficient 288865-15-6D, Barium bismuth cerium gadolinium oxide (Ba0.99Bi0.1Ce0.8Gd0.2O3), oxygen-deficient 288865-16-7D, Barium bismuth cerium gadolinium oxide (Ba0.98Bi0.04Ce0.8Gd0.2O3), oxygen-deficient 288865-17-8D, Barium bismuth cerium gadolinium oxide (Ba0.9Bi0.1Ce0.8Gd0.2O3), oxygen-deficient 288865-18-9D, Barium bismuth cerium gadolinium oxide (Ba0.98Bi0.04Ce0.8Gd0.16O3), oxygen-deficient 288865-19-0D, Barium cerium gadolinium lead oxide (Ba0.99Ce0.8Gd0.2Pb0.01O3), oxygen-deficient 288865-20-3D, Barium cerium gadolinium lead oxide (Ba0.99Ce0.8Gd0.2Pb0.1O3), oxygen-deficient 288865-21-4D, Barium cerium gadolinium lead oxide (Ba0.98Ce0.8Gd0.2Pb0.04O3), oxygen-deficient 288865-22-5D, Barium cerium gadolinium lead oxide (Ba0.9Ce0.8Gd0.2Pb0.1O3), oxygen-deficient 288865-23-6D, Barium cerium gadolinium lead oxide (Ba0.98Ce0.8Gd0.16Pb0.04O3), oxygen-deficient **288865-24-7D**, Barium cerium gadolinium gallium oxide (Ba0.99Ce0.8Gd0.2Ga0.01O3), oxygen-deficient **288865-25-8D**, Barium cerium gadolinium gallium oxide (Ba0.99Ce0.8Gd0.2Ga0.1O3), oxygen-deficient **288865-26-9D**, Barium cerium gadolinium gallium oxide (Ba0.98Ce0.8Gd0.2Ga0.04O3), oxygen-deficient **288865-27-0D**, Barium cerium gadolinium gallium oxide (Ba0.9Ce0.8Gd0.2Ga0.1O3), oxygen-deficient **288865-28-1D**, Barium cerium gadolinium gallium oxide (Ba0.98Ce0.8Gd0.16Ga0.04O3), oxygen-deficient 288865-29-2D, Barium cerium gadolinium vanadium oxide (Ba0.98Ce0.8Gd0.2V0.04O3), oxygen-deficient 288865-30-5D, Barium cerium gadolinium neodymium oxide (Ba0.98Ce0.8Gd0.2Nd0.04O3), oxygen-deficient 288865-31-6D, Barium cerium chromium gadolinium oxide (Ba0.98Ce0.8Cr0.04Gd0.2O3), oxygen-deficient 288865-32-7D, oxygen-deficient 288865-33-8D, Barium cerium gadolinium tungsten oxide (Ba0.98Ce0.8Gd0.2W0.04O3), oxygen-deficient 288865-34-9D, Barium cerium gadolinium **iron oxide** (Ba0.98Ce0.8Gd0.2Fe0.04O3), oxygen-deficient 288865-35-0D, Barium cerium cobalt gadolinium oxide (Ba0.98Ce0.8Co0.04Gd0.2O3), oxygen-deficient 288865-36-1D, Barium cerium gadolinium **nickel oxide** (Ba0.98Ce0.8Gd0.2Ni0.04O3), oxygen-deficient 288865-37-2D, Barium cerium copper gadolinium oxide (Ba0.98Ce0.8Cu0.04Gd0.2O3), oxygen-deficient 288865-38-3D, Barium cerium gadolinium silver oxide (Ba0.98Ce0.8Gd0.2Ag0.04O3), oxygen-deficient 288865-39-4D, Barium cerium gadolinium gold oxide (Ba0.98Ce0.8Gd0.2Au0.04O3), oxygen-deficient 288865-40-7D, Barium cerium gadolinium palladium oxide (Ba0.98Ce0.8Gd0.2Pd0.04O3), oxygen-deficient 288865-41-8D, Barium cerium gadolinium platinum oxide (Ba0.98Ce0.8Gd0.2Pt0.04O3), oxygen-deficient 288865-42-9D, Antimony barium cerium gadolinium oxide (Sb0.04Ba0.98Ce0.8Gd0.2O3), oxygen-deficient 288865-43-0D, Barium cerium gadolinium tin oxide (Ba0.98Ce0.8Gd0.2Sn0.04O3), oxygen-deficient 288865-44-1D, Barium yttrium zirconium oxide (BaY0.16Zr0.84O3), oxygen-deficient 288865-45-2D, Barium yttrium zirconium oxide (BaY0.25Zr0.75O3), oxygen-deficient 288865-46-3D, Barium yttrium zirconium oxide (BaY0.3Zr0.7O3), oxygen-deficient 288865-47-4D, Barium yttrium zirconium oxide (BaY0.35Zr0.65O3), oxygen-deficient 288865-48-5D, Barium indium zirconium oxide (BaIn0.3Zr0.7O3), oxygen-deficient 288865-49-6D, Barium gadolinium zirconium oxide (BaGd0.05Zr0.95O3), oxygen-deficient 288865-50-9D, Barium gadolinium

(BaCe0.01Gd0.29Zr0.7O3), oxygen-deficient 288865-96-3D, Barium cerium dysprosium zirconium oxide (BaCe0.05Dy0.15Zr0.8O3), oxygen-deficient 288865-97-4D, Barium cerium lanthanum zirconium oxide (BaCe0.4La0.2Zr0.4O3), oxygen-deficient 288865-98-5D, Barium bismuth cerium zirconium oxide (BaBi0.05Ce0.4Zr0.65O3), oxygen-deficient 288865-99-6D, oxygen-deficient 288866-01-3D, oxygen-deficient 288866-02-4D, Barium cerium neodymium zirconium oxide (BaCe0.2Nd0.1Zr0.7O3), oxygen-deficient 288866-04-6D, Barium cerium neodymium zirconium oxide (BaCe0.4Nd0.05Zr0.45O3), oxygen-deficient 288866-05-7D, Barium cerium neodymium zirconium oxide (BaCe0.4Nd0.2Zr0.4O3), oxygen-deficient 288866-06-8D, Barium cerium promethium zirconium oxide (BaCe0.4Pm0.2Zr0.4O3), oxygen-deficient 288866-08-0D, Barium cerium promethium zirconium oxide (BaCe0.4Pm0.1Zr0.5O3), oxygen-deficient 288866-10-4D, Barium cerium samarium zirconium oxide (BaCe0.4Sm0.1Zr0.5O3), oxygen-deficient 288866-12-6D, Barium cerium samarium zirconium oxide (BaCe0.1Sm0.2Zr0.7O3), oxygen-deficient 288866-14-8D, Barium cerium europium zirconium oxide (BaCe0.4Eu0.2Zr0.4O3), oxygen-deficient 288866-15-9D, Barium cerium europium zirconium oxide (BaCe0.4Eu0.1Zr0.5O3), oxygen-deficient 288866-16-0D, Barium cerium terbium zirconium oxide (BaCe0.4Tb0.05Zr0.55O3), oxygen-deficient 288866-17-1D, Barium cerium zirconium hydroxide oxide (BaCe0.05Zr0.8(OH)0.15O2.85), oxygen-deficient 288866-18-2D, Barium cerium thulium zirconium oxide (BaCe0.5Tm0.15Zr0.35O3), oxygen-deficient **288866-19-3D**, Barium cerium gallium zirconium oxide (BaCe0.4Ga0.2Zr0.4O3), oxygen-deficient **288866-20-6D**, Barium cerium gallium zirconium oxide (BaCe0.05Ga0.25Zr0.7O3), oxygen-deficient 288866-21-7D, Barium cerium tin zirconium oxide (BaCe0.1Sn0.1Zr0.8O3), oxygen-deficient 288866-22-8D, Barium cerium tin zirconium oxide (BaCe0.05Sn0.2Zr0.75O3), oxygen-deficient 288866-23-9D, Antimony barium cerium zirconium oxide (Sb0.2BaCe0.4Zr0.4O3), oxygen-deficient 288866-24-0D, Barium cerium indium zirconium oxide (BaCe0.4In0.2Zr0.4O3), oxygen-deficient 288866-25-1D, Barium cerium indium zirconium oxide (BaCe0.2In0.2Zr0.6O3), oxygen-deficient 288866-26-2D, Barium cerium indium zirconium oxide (BaCe0.4In0.1Zr0.5O3), oxygen-deficient 288866-27-3D, Barium cerium indium zirconium oxide (BaCe0.5In0.1Zr0.4O3), oxygen-deficient 288866-28-4D, Barium cerium indium zirconium oxide (BaCe0.5In0.2Zr0.3O3), oxygen-deficient 288866-29-5D, Barium cerium indium zirconium oxide (Ba0.99Ce0.4In0.2Zr0.4O3), oxygen-deficient
RL: DEV (Device component use); PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
(**perovskite**-type mixed ionic conductors for **fuel cells** and gas **sensors**)

IT **288865-24-7D**, Barium cerium gadolinium gallium oxide (Ba0.99Ce0.8Gd0.2Ga0.01O3), oxygen-deficient **288865-25-8D**, Barium cerium gadolinium gallium oxide (Ba0.99Ce0.8Gd0.2Ga0.1O3), oxygen-deficient **288865-26-9D**, Barium cerium gadolinium gallium oxide (Ba0.98Ce0.8Gd0.2Ga0.04O3), oxygen-deficient **288865-27-0D**, Barium cerium gadolinium gallium oxide (Ba0.9Ce0.8Gd0.2Ga0.1O3), oxygen-deficient **288865-28-1D**, Barium cerium gadolinium gallium oxide (Ba0.98Ce0.8Gd0.16Ga0.04O3), oxygen-deficient **288866-19-3D**, Barium cerium gallium zirconium oxide (BaCe0.4Ga0.2Zr0.4O3), oxygen-deficient **288866-20-6D**, Barium cerium gallium zirconium oxide (BaCe0.05Ga0.25Zr0.7O3), oxygen-deficient
RL: DEV (Device component use); PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
(**perovskite**-type mixed ionic conductors for **fuel cells** and gas **sensors**)

RN 288865-24-7 HCA
CN Barium cerium gadolinium gallium oxide (Ba0.99Ce0.8Gd0.2Ga0.01O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.01	7440-55-3
Gd	0.2	7440-54-2
Ce	0.8	7440-45-1
Ba	0.99	7440-39-3

RN 288865-25-8 HCA
CN Barium cerium gadolinium gallium oxide (Ba0.99Ce0.8Gd0.2Ga0.1O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.1	7440-55-3
Gd	0.2	7440-54-2
Ce	0.8	7440-45-1
Ba	0.99	7440-39-3

RN 288865-26-9 HCA
CN Barium cerium gadolinium gallium oxide (Ba0.98Ce0.8Gd0.2Ga0.04O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.04	7440-55-3
Gd	0.2	7440-54-2
Ce	0.8	7440-45-1
Ba	0.98	7440-39-3

RN 288865-27-0 HCA
CN Barium cerium gadolinium gallium oxide (Ba0.9Ce0.8Gd0.2Ga0.1O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.1	7440-55-3
Gd	0.2	7440-54-2
Ce	0.8	7440-45-1
Ba	0.9	7440-39-3

RN 288865-28-1 HCA
CN Barium cerium gadolinium gallium oxide (Ba0.98Ce0.8Gd0.16Ga0.04O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number

O	3	17778-80-2
Ga	0.04	7440-55-3
Gd	0.16	7440-54-2
Ce	0.8	7440-45-1
Ba	0.98	7440-39-3

RN 288866-19-3 HCA
CN Barium cerium gallium zirconium oxide (BaCe0.4Ga0.2Zr0.4O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Zr	0.4	7440-67-7
Ga	0.2	7440-55-3
Ce	0.4	7440-45-1
Ba	1	7440-39-3

RN 288866-20-6 HCA
CN Barium cerium gallium zirconium oxide (BaCe0.05Ga0.25Zr0.7O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Zr	0.7	7440-67-7
Ga	0.25	7440-55-3
Ce	0.05	7440-45-1
Ba	1	7440-39-3

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130:184527 Rare earth-gallate-type mixed metal oxides with perovskite structure as novel electrically conducting oxides. Ishihara, Tatsumi; Takita, Yusaku (Mitsubishi Materials Corp., Japan). Ger. Offen. DE 19839382 A1 **19990304**, 22 pp. (German). CODEN: GWXXBX. APPLICATION: DE 1998-19839382 19980831. PRIORITY: JP 1997-234838 19970829; JP 1998-79583 19980326; JP 1998-81185 19980327.

AB Oxide conductors were described with the following composition: Ln1-xAxGa1-a-zB1yB2zO3, in which: (1) Ln is 1, 2, or more elements chosen from the group La, Ce, Pr, Nd, and Sm. (2) A is 1, 2, or more elements chosen from the group Sr, Ca, and Ba, (3) B1 is 1, 2, or more elements chosen from the group Mg, Al, and In, (4) B2 is 1, 2, or more elements chosen from the group Co, Fe, Ni, and Cu, and (5) x = 0.05-0.3; a = 0-0.29; z = 0.01-0.3; and a + z = 0.025-0.3. A preferred oxide is of general formula La1-xSrxGa1-a-zMgyFezO3, in which x = 0.1-0.3, a = 0.025-0.29, z = 0.01-0.15, and a + z = 0.35-0.3. These oxide conductors are of the rare earth gallate type with a perovskite structure, they have a very high oxide or mixed oxide elec. conductivity without being significantly influenced by the oxygen partial pressure, and can be effectively used as **electrolytes** of **fuel cells**, (e.g., in the air electrode of a **fuel cell**), in a gas **sensor** (such as an oxygen **sensor**), in an oxygen-separating film (such as in an electrochem. **oxygen pump**), and in gas separation membranes.

IC ICM C01G001-02
ICS H01M004-86; B01D053-22; G01N027-407
CC 49-4 (Industrial Inorganic Chemicals)
Section cross-reference(s): 51, 72
ST **oxygen pumping** mixed oxide solid electrolyte; rare earth transition metal mixed oxide electrolyte; perovskite rare earth mixed oxide solid electrolyte; gas **sensor** mixed oxide solid electrolyte; **fuel cell** mixed oxide solid electrolyte
IT Solid electrolyte gas **sensors**
Solid state fuel cells
(**solid electrolytes** for; rare earth-gallate-type mixed metal oxides with perovskite structure as novel elec. conducting oxides)
IT **165900-07-2P**, Gallium lanthanum magnesium strontium oxide (Ga0.8La0.8Mg0.2Sr0.2O3 **203735-99-3P**, Gallium iron lanthanum magnesium strontium oxide (Ga0.8Fe0.1La0.8Mg0.1Sr0.2O3) **203736-00-9P**, Cobalt gallium lanthanum magnesium strontium oxide (Co0.1Ga0.8La0.8Mg0.1Sr0.2O3) **203736-01-0P**, Gallium lanthanum magnesium nickel strontium oxide (Ga0.8La0.8Mg0.1Ni0.1Sr0.2O3) **203736-02-1P**, Copper gallium lanthanum magnesium strontium oxide (Cu0.1Ga0.8La0.8Mg0.1Sr0.2O3) **203736-03-2P**, Gallium lanthanum magnesium manganese strontium oxide (Ga0.8La0.8Mg0.1Mn0.1Sr0.2O3)
203736-04-3P 220667-93-6P 220667-95-8P
220667-97-0P 220667-99-2P 220668-01-9P
220668-02-0P 220668-03-1P 220668-05-3P
220668-07-5P 220668-08-6P 220668-10-0P
220668-11-1P 220668-13-3P 220668-14-4P
220668-17-7P 220668-19-9P 220668-20-2P
220668-22-4P 220668-23-5P
RL: DEV (Device component use); PRP (Properties); SPN (Synthetic preparation); PREP (Preparation); USES (Uses)
(perovskite, electrolyte; rare earth-gallate-type mixed metal oxides with perovskite structure as novel elec. conducting oxides)
IT **165900-07-2P**, Gallium lanthanum magnesium strontium oxide (Ga0.8La0.8Mg0.2Sr0.2O3 **203735-99-3P**, Gallium iron lanthanum magnesium strontium oxide (Ga0.8Fe0.1La0.8Mg0.1Sr0.2O3) **203736-00-9P**, Cobalt gallium lanthanum magnesium strontium oxide (Co0.1Ga0.8La0.8Mg0.1Sr0.2O3) **203736-01-0P**, Gallium lanthanum magnesium nickel strontium oxide (Ga0.8La0.8Mg0.1Ni0.1Sr0.2O3) **203736-02-1P**, Copper gallium lanthanum magnesium strontium oxide (Cu0.1Ga0.8La0.8Mg0.1Sr0.2O3) **203736-03-2P**, Gallium lanthanum magnesium manganese strontium oxide (Ga0.8La0.8Mg0.1Mn0.1Sr0.2O3)
203736-04-3P 220667-93-6P 220667-95-8P
220667-97-0P 220667-99-2P 220668-01-9P
220668-02-0P 220668-03-1P 220668-05-3P
220668-07-5P 220668-08-6P 220668-10-0P
220668-11-1P 220668-13-3P 220668-14-4P
220668-17-7P 220668-19-9P 220668-20-2P
220668-22-4P 220668-23-5P
RL: DEV (Device component use); PRP (Properties); SPN (Synthetic preparation); PREP (Preparation); USES (Uses)
(perovskite, electrolyte; rare earth-gallate-type mixed metal oxides with perovskite structure as novel elec. conducting oxides)
RN 165900-07-2 HCA
CN Gallium lanthanum magnesium strontium oxide (Ga0.8La0.8Mg0.2Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component

		Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Sr	0.2	7440-24-6
Mg	0.2	7439-95-4
La	0.8	7439-91-0

RN 203735-99-3 HCA
CN Gallium iron lanthanum magnesium strontium oxide (Ga0.8Fe0.1La0.8Mg0.1Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Sr	0.2	7440-24-6
Mg	0.1	7439-95-4
La	0.8	7439-91-0
Fe	0.1	7439-89-6

RN 203736-00-9 HCA
CN Cobalt gallium lanthanum magnesium strontium oxide (Co0.1Ga0.8La0.8Mg0.1Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.1	7440-48-4
Sr	0.2	7440-24-6
Mg	0.1	7439-95-4
La	0.8	7439-91-0

RN 203736-01-0 HCA
CN Gallium lanthanum magnesium nickel strontium oxide (Ga0.8La0.8Mg0.1Ni0.1Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Sr	0.2	7440-24-6
Ni	0.1	7440-02-0
Mg	0.1	7439-95-4
La	0.8	7439-91-0

RN 203736-02-1 HCA
CN Copper gallium lanthanum magnesium strontium oxide (Cu0.1Ga0.8La0.8Mg0.1Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2

Ga	0.8	7440-55-3
Cu	0.1	7440-50-8
Sr	0.2	7440-24-6
Mg	0.1	7439-95-4
La	0.8	7439-91-0

RN 203736-03-2 HCA
CN Gallium lanthanum magnesium manganese strontium oxide (Ga0.8La0.8Mg .1Mn0.1Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Sr	0.2	7440-24-6
Mn	0.1	7439-96-5
Mg	0.1	7439-95-4
La	0.8	7439-91-0

RN 203736-04-3 HCA
CN Cobalt gallium lanthanum magnesium strontium oxide (Co0.08Ga0.8La0.9Mg0.12Sr0.1O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.08	7440-48-4
Sr	0.1	7440-24-6
Mg	0.12	7439-95-4
La	0.9	7439-91-0

RN 220667-93-6 HCA
CN Cobalt gallium lanthanum magnesium strontium oxide (Co0.08Ga0.8La0.8Mg0.12Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.08	7440-48-4
Sr	0.2	7440-24-6
Mg	0.12	7439-95-4
La	0.8	7439-91-0

RN 220667-95-8 HCA
CN Cobalt gallium lanthanum magnesium strontium oxide (Co0.08Ga0.8L 0.85Mg0.12Sr0.15O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.08	7440-48-4

Sr	0.15	7440-24-6
Mg	0.12	7439-95-4
La	0.85	7439-91-0

RN 220667-97-0 HCA
CN Cobalt gallium lanthanum magnesium strontium oxide (Co0.08Ga0.8La0.75Mg0.12Sr0.25O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.08	7440-48-4
Sr	0.25	7440-24-6
Mg	0.12	7439-95-4
La	0.75	7439-91-0

RN 220667-99-2 HCA
CN Cobalt gallium lanthanum magnesium strontium oxide (Co0.08Ga0.8La0.7Mg0.12Sr0.3O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.08	7440-48-4
Sr	0.3	7440-24-6
Mg	0.12	7439-95-4
La	0.7	7439-91-0

RN 220668-01-9 HCA
CN Cobalt gallium magnesium praseodymium strontium oxide (Co0.1Ga0.8Mg0.1Pr0.9Sr0.1O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.1	7440-48-4
Sr	0.1	7440-24-6
Pr	0.9	7440-10-0
Mg	0.1	7439-95-4

RN 220668-02-0 HCA
CN Cobalt gallium magnesium neodymium strontium oxide (Co0.1Ga0.8Mg0.1Nd0.9Sr0.1O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.1	7440-48-4
Sr	0.1	7440-24-6
Nd	0.9	7440-00-8

Mg	0.1	7439-95-4

RN 220668-03-1 HCA
CN Cerium cobalt gallium magnesium strontium oxide (Ce0.9Co0.1Ga0.8Mg0.1Sr0.1O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.1	7440-48-4
Ce	0.9	7440-45-1
Sr	0.1	7440-24-6
Mg	0.1	7439-95-4

RN 220668-05-3 HCA
CN Cobalt gallium lanthanum magnesium strontium oxide (Co0.1Ga0.8La0.9Mg0.1Sr0.1O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.1	7440-48-4
Sr	0.1	7440-24-6
Mg	0.1	7439-95-4
La	0.9	7439-91-0

RN 220668-07-5 HCA
CN Cobalt gallium magnesium samarium strontium oxide (Co0.1Ga0.8Mg0.1Sm0.9Sr0.1O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.1	7440-48-4
Sr	0.1	7440-24-6
Sm	0.9	7440-19-9
Mg	0.1	7439-95-4

RN 220668-08-6 HCA
CN Calcium cobalt gallium lanthanum magnesium oxide (Ca0.1Co0.1Ga0.8La0.9Mg0.1O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ca	0.1	7440-70-2
Ga	0.8	7440-55-3
Co	0.1	7440-48-4
Mg	0.1	7439-95-4
La	0.9	7439-91-0

RN 220668-10-0 HCA
CN Barium cobalt gallium lanthanum magnesium oxide
(Ba0.1Co0.1Ga0.8La0.9Mg0.1O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.1	7440-48-4
Ba	0.1	7440-39-3
Mg	0.1	7439-95-4
La	0.9	7439-91-0

RN 220668-11-1 HCA
CN Aluminum cobalt gallium lanthanum strontium oxide
(Al0.1Co0.1Ga0.8La0.9Sr0.1O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Co	0.1	7440-48-4
Sr	0.1	7440-24-6
La	0.9	7439-91-0
Al	0.1	7429-90-5

RN 220668-13-3 HCA
CN Cobalt gallium indium lanthanum strontium oxide
(Co0.1Ga0.8In0.1La0.9Sr0.1O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
In	0.1	7440-74-6
Ga	0.8	7440-55-3
Co	0.1	7440-48-4
Sr	0.1	7440-24-6
La	0.9	7439-91-0

RN 220668-14-4 HCA
CN Gallium iron lanthanum magnesium strontium oxide
(Ga0.8(Fe,Mg)0.2La0.8Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Sr	0.2	7440-24-6
Mg	0 - 0.2	7439-95-4
La	0.8	7439-91-0
Fe	0 - 0.2	7439-89-6

RN 220668-17-7 HCA
CN Cobalt gallium lanthanum magnesium strontium oxide (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	x	17778-80-2
Ga	x	7440-55-3
Co	x	7440-48-4
Sr	x	7440-24-6
Mg	x	7439-95-4
La	x	7439-91-0

RN 220668-19-9 HCA
CN Gallium iron lanthanum magnesium strontium oxide (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	x	17778-80-2
Ga	x	7440-55-3
Sr	x	7440-24-6
Mg	x	7439-95-4
La	x	7439-91-0
Fe	x	7439-89-6

RN 220668-20-2 HCA
CN Gallium iron lanthanum magnesium strontium oxide (Ga0.8Fe0.03La0.8Mg0.17Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Sr	0.2	7440-24-6
Mg	0.17	7439-95-4
La	0.8	7439-91-0
Fe	0.03	7439-89-6

RN 220668-22-4 HCA
CN Gallium iron lanthanum magnesium strontium oxide (Ga0.8Fe0.05La0.8Mg0.15Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Ga	0.8	7440-55-3
Sr	0.2	7440-24-6
Mg	0.15	7439-95-4
La	0.8	7439-91-0
Fe	0.05	7439-89-6

RN 220668-23-5 HCA
CN Gallium iron lanthanum magnesium strontium oxide (Ga0.8Fe0.15La0.8Mg0.05Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number

O	3	17778-80-2
Ga	0.8	7440-55-3
Sr	0.2	7440-24-6
Mg	0.05	7439-95-4
La	0.8	7439-91-0
Fe	0.15	7439-89-6

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L89 ANSWER 1 OF 9 HCA COPYRIGHT 2004 ACS on STN
140:7080 Zero emission power generation using an all **perovskite fuel cell**. Kilner, J. A.; Skinner, S. J.; Ishihara, T.; Otsuka, K.; Irvine, J. T. S.; McColm, T.; Jiang, Y. (Department of Materials, Imperial College of Science Technology and Medicine, London, SW7 2BP, UK). Proceedings - Electrochemical Society, 2001-16(Solid Oxide Fuel Cells VII), 224-233 (English) **2001**. CODEN: PESODO. ISSN: 0161-6374. Publisher: Electrochemical Society.

AB The development of a novel type of **fuel cell** system is described which will provide a zero-emission device when fueled by methane. The system consists of an intermediate temperature solid oxide **fuel cell** (ITSOFC), based on **perovskite** materials only, which is supplied with H from a catalytic reactor for the decomposition of methane. Development of the materials for the ITSOFC are described together with the introduction of a novel methane processing system that provides an effective means for the storage and distribution of H.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 59

ST methane hydrogen **perovskite** anode **electrolyte** cathode **fuel cell**

IT Power
(generation; zero emission power generation with **perovskite**-based **fuel cell**)

IT **Solid state fuel cells**
(oxide; zero emission power generation with **perovskite**-based **fuel cell**)

IT **Perovskite**-type crystals
(zero emission power generation with **perovskite**-based **fuel cell**)

IT 7440-02-0, Nickel, uses
RL: CAT (Catalyst use); DEV (Device component use); USES (Uses)
(anode; zero emission power generation with **perovskite**-based **fuel cell**)

IT 78519-55-8, Gallium niobium strontium oxide ($GaNbSr_2O_6$)
220697-02-9D, Cobalt gallium lanthanum magnesium strontium oxide ($Co_{0.05}Ga_{0.8}La_{0.8}Mg_{0.15}Sr_{0.2}O_3$), composites with nickel
RL: DEV (Device component use); USES (Uses)
(anode; zero emission power generation with **perovskite**-based **fuel cell**)

IT 210968-16-4, Barium cobalt lanthanum oxide ($Ba_{0.6}CoLa_{0.4}O_3$)
RL: DEV (Device component use); USES (Uses)
(cathode; zero emission power generation with **perovskite**-based **fuel cell**)

IT 7440-02-0D, Nickel, composites containing
RL: DEV (Device component use); USES (Uses)
(composites with mixed oxides, anode; zero emission power generation with **perovskite**-based **fuel cell**)

IT 110687-91-7, Cerium strontium ytterbium oxide (Ce0.95SrYb0.05O3) 162105-72-8, Cerium samarium oxide (Ce0.8Sm0.2O2) 627517-74-2, Magnesium strontium titanium oxide (Mg0.07SrTi0.93O3) 627517-77-5, Scandium zirconium oxide (Sc0.18Zr0.82O2) 627517-79-7, Cerium samarium oxide (Ce0.82Sm0.15O2)
RL: DEV (Device component use); USES (Uses)
(composites with nickel, anode; zero emission power generation with **perovskite**-based **fuel cell**)

IT **165900-07-2**, Gallium lanthanum magnesium strontium oxide (Ga0.8La0.8Mg0.2Sr0.2O3) **220697-02-9**, Cobalt gallium lanthanum magnesium strontium oxide (Co0.05Ga0.8La0.8Mg0.15Sr0.2O3) **241142-05-2**, Gallium lanthanum magnesium nickel strontium oxide (Ga0.8La0.8Mg0.13Ni0.07Sr0.2O3)
RL: DEV (Device component use); USES (Uses)
(electrolyte; zero emission power generation with **perovskite**-based **fuel cell**)

IT 1317-61-9, **Iron oxide** (Fe3O4), uses
RL: CPS (Chemical process); DEV (Device component use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
(in zero emission power generation with **perovskite**-based **fuel cell**)

IT 74-82-8, Methane, uses
RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)
(zero emission power generation with **perovskite**-based **fuel cell** fueled with)

IT **220697-02-9D**, Cobalt gallium lanthanum magnesium strontium oxide (Co0.05Ga0.8La0.8Mg0.15Sr0.2O3), composites with nickel
RL: DEV (Device component use); USES (Uses)
(anode; zero emission power generation with **perovskite**-based **fuel cell**)

IT **165900-07-2**, Gallium lanthanum magnesium strontium oxide (Ga0.8La0.8Mg0.2Sr0.2O3) **220697-02-9**, Cobalt gallium lanthanum magnesium strontium oxide (Co0.05Ga0.8La0.8Mg0.15Sr0.2O3) **241142-05-2**, Gallium lanthanum magnesium nickel strontium oxide (Ga0.8La0.8Mg0.13Ni0.07Sr0.2O3)
RL: DEV (Device component use); USES (Uses)
(electrolyte; zero emission power generation with **perovskite**-based **fuel cell**)

L89 ANSWER 2 OF 9 HCA COPYRIGHT 2004 ACS on STN
136:72348 Solid oxide **fuel cell** having **perovskite** solid electrolytes. Hara, Naoki; Munakata, Fumio; Iwasaki, Yasukazu (Nissan Motor Co., Ltd., Japan). Eur. Pat. Appl. EP 1170812 A2 20020109, 21 pp. DESIGNATED STATES: R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO. (English). CODEN: EPXXDW. APPLICATION: EP 2001-116116 20010703. PRIORITY: JP 2000-202262 20000704; JP 2001-184554 20010619.

AB A solid oxide **fuel cell** (**SOFC**) contains a first solid electrolyte layer of LaGa-based **perovskite**, an air electrode, a fuel electrode and a second solid electrolyte layer (having a hole transport number smaller than that of the first solid electrolyte layer), which is provided between the first solid electrolyte layer and an

air electrode. Also, another **SOFC** contains a first solid electrolyte layer of LaGa-based **perovskite**, an air electrode, a fuel electrode and a third solid electrolyte layer (having electron and proton conductivity lower than that of the first solid electrolyte layer), which
is provided between the first solid electrolyte layer and the fuel electrode. Still another **SOFC** contains the second solid electrolyte layer provided between a first solid electrolyte layer and an air electrode and the third solid electrolyte layer provided between the first solid electrolyte layer and a fuel electrode.

IC ICM H01M008-12

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 76

ST **fuel cell perovskite** solid
electrolyte

IT Transference number
(ionic; solid oxide **fuel cell** having
perovskite solid electrolytes)

IT Sputtering
(radio-frequency; solid oxide **fuel cell** having
perovskite solid electrolytes)

IT **Fuel cell electrolytes**
Ionic conductivity
Perovskite-type crystals
Screen printing
Sintering
Solid state fuel cells
(**solid** oxide **fuel cell** having
perovskite solid electrolytes)

IT 1314-36-9, Yttria, uses
RL: DEV (Device component use); USES (Uses)
(ZrO_2 stabilized with; solid oxide **fuel cell** having
perovskite solid electrolytes)

IT 12060-58-1, Samarium oxide (Sm_2O_3)
RL: MOA (Modifier or additive use); USES (Uses)
(ceria containing; solid oxide **fuel cell** having
perovskite solid electrolytes)

IT 1306-38-3, Ceria, uses
RL: DEV (Device component use); USES (Uses)
(samaria-added; solid oxide **fuel cell** having
perovskite solid electrolytes)

IT 7440-06-4, Platinum, uses 7440-22-4, Silver, uses 64417-98-7, Yttrium zirconium oxide **384338-66-3D**, O-deficient **384338-67-4D**
, O-deficient
RL: DEV (Device component use); USES (Uses)
(solid oxide **fuel cell** having **perovskite**
solid electrolytes)

IT 1314-23-4, **Zirconia**, uses
RL: DEV (Device component use); USES (Uses)
(yttria-stabilized; solid oxide **fuel cell** having
perovskite solid electrolytes)

IT **384338-66-3D**, O-deficient **384338-67-4D**, O-deficient
RL: DEV (Device component use); USES (Uses)
(solid oxide **fuel cell** having **perovskite**
solid electrolytes)

L89 ANSWER 3 OF 9 HCA COPYRIGHT 2004 ACS on STN
135:259781 Fuel gas/air mixture-type solid **electrolyte fuel**

cell. Sano, Mitsuru (Japan). Jpn. Kokai Tokkyo Koho JP 2001256986 A2 **20010921**, 8 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2000-114429 20000310.

AB The **fuel cell** is equipped with (1) a stabilized ZrO2-based solid electrolyte sheet, (2) a cermet electrode from a mixture containing 5-30 weight% CeO2 doped with 10-30 mol% Sm and/or Gd and balance NiO on one side, and (3) an electrode containing Sm cobaltite (in which 30-70 mol% Sm is substituted with Sr) or La cobaltite (in which 30-50 mol% La is substituted with Sr), where a gas mixture containing lower hydrocarbon, lower alc., or liquefied petroleum gas and air having mixing ratio for giving partial oxidation reaction is introduced to the both electrodes. Also claimed is a **fuel cell** equipped with (1') a **perovskite**-structure La Ga oxide-based solid electrolyte (in which 10-30 mol% La is substituted with Sr and 10-30 mol% Ga is substituted with Mg), (2), and (3). Also claimed is a **fuel cell** equipped with (1") a fluorite-structure CeO2 solid electrolyte doped with 10-30 mol% Sm, (2), and (3). The **fuel cell** has simple cell structure and do not need to sep. air from a fuel gas.

IC ICM H01M008-02
ICS H01M004-86; H01M008-06; H01M008-12

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST nickel cermet anode samarium gadolinium doped ceria **fuel cell**; samarium strontium cobaltite cathode solid **electrolyte fuel cell**; lanthanum strontium cobaltite cathode **fuel cell**

IT **Fuel cell** anodes
Fuel cell cathodes
Fuel cell electrolytes
Solid state fuel cells
(**fuel** gas/air mixture-type solid **electrolyte fuel cell** with nickel cermet anode and Sr-substituted Sm or La cobaltite cathode)

IT Petroleum products
RL: TEM (Technical or engineered material use); USES (Uses)
(gases, liquefied; fuel gas/air mixture-type solid **electrolyte fuel cell** with nickel cermet anode and Sr-substituted Sm or La cobaltite cathode)

IT Alcohols, uses
Hydrocarbons, uses
RL: TEM (Technical or engineered material use); USES (Uses)
(lower; fuel gas/air mixture-type solid **electrolyte fuel cell** with nickel cermet anode and Sr-substituted Sm or La cobaltite cathode)

IT 12310-74-6, Cobalt lanthanum strontium oxide (Co2LaSrO6) 59989-70-7, Cobalt samarium strontium oxide (Co2SmSrO6) 107121-69-7, Cobalt lanthanum strontium oxide (CoLa0.7Sr0.3O3) 110620-52-5, Cobalt lanthanum strontium oxide (CoLa0.6Sr0.4O3) 112593-65-4, Cobalt lanthanum strontium oxide (CoLa0.3Sr0.7O3) 149350-30-1, Cobalt samarium strontium oxide (CoSm0.7Sr0.3O3) 189322-66-5, Cobalt samarium strontium oxide (CoSm0.3Sr0.7O3)
RL: DEV (Device component use); USES (Uses)
(cathode; fuel gas/air mixture-type solid **electrolyte fuel cell** with nickel cermet anode and Sr-substituted Sm or La cobaltite cathode)

IT 1313-99-1, **Nickel oxide** (NiO), uses
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
(cermet from Sm- and/or Gd-doped ceria and, anode; fuel gas/air

mixture-type solid **electrolyte fuel cell**
with nickel cermet anode and Sr-substituted Sm or La cobaltite cathode)

IT 110831-77-1, Cerium gadolinium oxide (Ce0.7Gd0.3O1.85) 116875-84-4, Cerium samarium oxide (Ce0.8Sm0.2O1.9) 117655-28-4, Cerium samarium oxide (Ce0.7Sm0.3O1.85) 117655-29-5, Cerium samarium oxide (Ce0.9Sm0.1O1.95) 117655-32-0, Cerium gadolinium oxide (Ce0.8Gd0.2O1.9) 152233-89-1, Cerium gadolinium oxide (Ce0.9Gd0.1O1.95) 361444-63-5, Cerium samarium oxide (Ce0.9Sm0.1O1.85)
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
(cermet from **nickel oxide** and, anode; fuel gas/air mixture-type solid **electrolyte fuel cell** with nickel cermet anode and Sr-substituted Sm or La cobaltite cathode)

IT 114168-16-0, Yttrium Zirconium oxide (Y0.16Zr0.92O2.08)
155343-26-3 165900-07-2 207739-73-9
RL: DEV (Device component use); USES (Uses)
(electrolyte; fuel gas/air mixture-type solid **electrolyte fuel cell** with nickel cermet anode and Sr-substituted Sm or La cobaltite cathode)

IT 64-17-5, Ethanol, uses 67-56-1, Methanol, uses 74-82-8, Methane, uses 74-84-0, Ethane, uses 74-98-6, Propane, uses 106-97-8, Butane, uses
RL: TEM (Technical or engineered material use); USES (Uses)
(fuel gas/air mixture-type solid **electrolyte fuel cell** with nickel cermet anode and Sr-substituted Sm or La cobaltite cathode)

IT **155343-26-3 165900-07-2 207739-73-9**
RL: DEV (Device component use); USES (Uses)
(electrolyte; fuel gas/air mixture-type solid **electrolyte fuel cell** with nickel cermet anode and Sr-substituted Sm or La cobaltite cathode)

L89 ANSWER 4 OF 9 HCA COPYRIGHT 2004 ACS on STN

135:124922 **Perovskite** oxide-ion conductors: Electrolytes and electrodes. Goodenough, J. B.; Huang, K. (Texas Materials Institute, University of Texas at Austin, Austin, TX, 78712, USA). Advances in Science and Technology (Faenza, Italy), 29(Mass and Charge Transport in Inorganic Materials, Part A), 3-13 (English) **2000**. CODEN: ASETE5. Publisher: Techna.

AB Selection of a compatible set of oxide-ion conductors for the fabrication of a solid oxide **fuel cell** (**SOFC**) operating at 700° represents a significant tech. challenge. For the past 25 yr, efforts to achieve this goal have been based on yttria stabilized **zirconia** (YSZ) as the electrolyte. This paper is a progress report on a **SOFC** based on a **perovskite**, Sr- and Mg-doped LaGaO3 (LSGM), as the electrolyte and mixed oxide-ion/electronic conductors (MIECs) as the electrodes. A thin, dense MIEC buffer layer between the electrolyte and a composite anode prevents chemical reactions at the electrode/electrolyte interface. Such a layer may also be used on the surface of an MIEC membrane stable in an oxidizing atmospheric to protect it from a reducing atmospheric to which it is exposed when used as an oxygen-permeation membrane. Preliminary tests show that an LSGM-based solid oxide **fuel cell** is competitive with one based on YSZ. Oxygen permeation studies show that the surface-reaction kinetics at an MIEC electrode or permeation membrane becomes more rate limiting at reduced temps. However, a catalytic coating can relieve this problem. Studies are needed to identify the optimal catalytic processes for fast surface kinetics.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
ST **fuel cell electrolyte** electrode
perovskite oxide ion conductor
IT Electric conductivity
Fuel cell cathodes
Fuel cell electrolytes
Ionic conductors
Perovskite-type crystals
Solid state fuel cells
Thermal expansion
(**perovskite** oxide-ion conductors as electrolytes and electrodes for **fuel cells**)
IT 12310-74-6D, Cobalt lanthanum strontium oxide CoLa0.5Sr0.5O3, O-deficient 107958-41-8D, Cobalt lanthanum nickel strontium oxide Co0.8La0.8Ni0.2Sr0.2O3, O-deficient 116738-88-6D, Cobalt iron strontium oxide Co0.8Fe0.2SrO3, O-deficient 116875-84-4D, Cerium samarium oxide Ce0.8Sm0.2O1.9, O-deficient 211292-96-5D, Iron lanthanum nickel strontium oxide Fe0.8La0.7Ni0.2Sr0.3O3, O-deficient
RL: DEV (Device component use); USES (Uses)
(**perovskite** oxide-ion conductors as electrolytes and electrodes for **fuel cells**)
IT **209455-29-8**, Gallium lanthanum magnesium strontium oxide Ga0.83La0.8Mg0.17Sr0.2O2.82
RL: DEV (Device component use); PRP (Properties); USES (Uses)
(**perovskite** oxide-ion conductors as electrolytes and electrodes for **fuel cells**)
IT **209455-29-8**, Gallium lanthanum magnesium strontium oxide Ga0.83La0.8Mg0.17Sr0.2O2.82
RL: DEV (Device component use); PRP (Properties); USES (Uses)
(**perovskite** oxide-ion conductors as electrolytes and electrodes for **fuel cells**)

L89 ANSWER 5 OF 9 HCA COPYRIGHT 2004 ACS on STN
134:240051 Phase characterization and electrical properties of LSM-LSGM system. Yi, Jae Yeon; Choi, Gyeong Man (Department of Materials Science and Engineering, Pohang University of Science and Technology, Pohang, 790-784, S. Korea). Solid State Ionics: Materials and Devices, [Proceedings of the Asian Conference], 7th, Fuzhou, China, Oct. 29-Nov. 4, 2000, 529-533. Editor(s): Chowdari, B. V. R.; Wang, Wenji. World Scientific Publishing Co. Pte. Ltd.: Singapore, Singapore. (English) **2000**. CODEN: 69AWLC.
AB LSGM (La0.9Sr0.1Ga0.8Mg0.2O3) and LSM (La0.9Sr0.1MnO3) are attractive electrolyte and cathode materials, resp., for the intermediate temperature solid oxide **fuel cells**. Since both materials are based on **perovskite** structure, the reaction between them is easily expected. In this study, various compns. of xLSM-(1-x)LSGM (x = 0 .apprx. 1) system were prepared to identify the possible reaction product and to see their effects on the elec. conductivity Powder compacts were prepared by using the **solid-state** reaction method and sintered at 1500°C for 6 h. The phase, analyzed from XRD patterns, changed from single-phase cubic at x = 0-0.16 to hexagonal at x = 0.2-0.5 and finally to orthorhombic at x = 0.60-1. The elec. conductivity of LSGM, measured by 4-probe d.c. method between 430°C and 910°C in air, decreased with increasing LSM content in the cubic composition range, showing the harmful effect of LSM on the electrolyte conductivity The conductivity decrease was

explained by the increase in the activation energy and the decrease in the charge carrier concentration Above x = 0.16, the conductivity increased rapidly,
showing the effect of percolation by the conductive hexagonal and orthorhombic phases.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 72, 76

ST solid oxide **fuel cell electrolyte** cathode;
lanthanum strontium gallium **manganese oxide**

IT Electric conductivity
Solid state fuel cells
Structural phase transition
(phase characterization and elec. properties of LSM-LSGM system)

IT **155343-26-3**, Gallium Lanthanum magnesium strontium oxide ga0.8la0.9mg0.2sr0.1o3
RL: DEV (Device component use); USES (Uses)
(electrolyte; phase characterization and elec. properties of LSM-LSGM system)

IT **155343-26-3**, Gallium Lanthanum magnesium strontium oxide ga0.8la0.9mg0.2sr0.1o3
RL: DEV (Device component use); USES (Uses)
(electrolyte; phase characterization and elec. properties of LSM-LSGM system)

L89 ANSWER 6 OF 9 HCA COPYRIGHT 2004 ACS on STN

134:59027 Alternative materials for components of high-temperature solid-oxide **fuel cell** (**SOFC**) for decrease of operating temperatures. Ahmad-Khanlou, Ariane (Institut Werkstoffe Verfahren Energietechnik, Germany). Berichte des Forschungszentrums Juelich, Juel-3797, i-ix, 1-123 (German) **2000**. CODEN: FJBEE5. ISSN: 0366-0885.

AB Components of the solid oxide **fuel cell** (**SOFC**) are exposed to temps. >1200° during fabrication. Moreover, they must withstand the operating temps. of about 850° for operating times of more than 40,000 h. Any interdiffusion processes occurring or the formation of reaction products can impair performance efficiency and service life. A reduction of the fabrication and operating temps. should therefore be aimed atomic Since the electrolyte of yttria-stabilized **zirconia** (YSZ) available at present only exhibits a sufficiently high ionic conductivity at temps. above 800°, the development of alternative membrane materials is required which must also guarantee high performance stability at reduced operating temps. In parallel to this, efforts are being made to enhance the **SOFC** performance by optimizing the cathode compds. already available. The alternative compds. must satisfy a number of further requirements in addition to high chemical stability. They must display e.g. a thermal expansion coefficient adapted to the other **SOFC** components for thermal cycling, excellent transport properties as well as high catalytic activity. For application as the electrolyte membrane, the La0.9Sr0.1Ga0.8Mg0.2O3-x and La0.8Sr0.2Ga0.9Mg0.1O3-x gallates were characterized in detail in this work. A single-phased nature difficult to establish, the tendency to Ga evaporation under oxidizing as well as reducing conditions and strong interactions with the electrode materials are decisive criteria for the inapplicability of these compds. in **SOFCs**. On the cathode side, substoichiometric **perovskites** based on LnMnO3 and LaFeO3 (with Ln = lanthanides) were primarily examined By selectively substituting these systems with strontium and cobalt it was intended to improve the material properties. A systematic characterization of these compds. with respect

to phase purity, thermal expansion coefficient, elec. and ionic conductivity served to
evaluate their applicability. Furthermore, investigations into chemical interactions with the standard YSZ electrolyte contributed towards selecting a number of suitable cathode materials which also had to prove efficient in **electrochem.** single-**cell** measurements. Apart from La0.65Sr0.3MnO3, which is used as the standard cathode material at Research Center Julich, the compds. Pr0.65Sr0.3MnO3 and Pr0.75Sr0.2Mn0.8Co0.2O3 may be considered as promising candidates enabling a reduction of the fabrication and operating temps.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST anode high temp solid oxide **fuel cell**; cathode high temp solid oxide **fuel cell**; electrolyte high temp solid oxide **fuel cell**

IT Activity (thermodynamic)
Electric resistance
Fuel cell anodes
Fuel cell cathodes
Fuel cell electrolytes
Ionic conductivity
Microstructure
Solid state fuel cells
Thermal expansion
(alternative materials for components of high-temperature solid-oxide **fuel cell** (**SOFC**) for decrease of operating temps.)

IT Diffusion
(interdiffusion; alternative materials for components of high-temperature solid-oxide **fuel cell** (**SOFC**) for decrease of operating temps.)

IT 108916-04-7, Cobalt lanthanum manganese strontium oxide (co0.2la0.8mn0.8sr0.2o3) 112510-20-0, Manganese praseodymium strontium oxide (MnPr0.7Sr0.3O3) 144698-19-1, Manganese praseodymium strontium oxide (MnPr0.8Sr0.2O3) 148595-68-0, Cobalt iron lanthanum strontium oxide (Co0.1Fe0.9La0.8Sr0.2O3) 157975-55-8, Lanthanum manganese strontium oxide (La0.65MnSr0.3O3) 164913-49-9, Cobalt lanthanum manganese strontium oxide (co0.2la0.65mn0.8sr0.3o3) 171610-63-2, Cobalt manganese praseodymium strontium oxide (Co0.2Mn0.8Pr0.8Sr0.2O3) 171610-64-3, Cobalt manganese praseodymium strontium oxide (Co0.3Mn0.7Pr0.8Sr0.2O3) **177027-87-1D**, oxygen deficient 180265-09-2, Cobalt lanthanum manganese strontium oxide (co0.1la0.75mn0.9sr0.2o3) 180265-10-5, Cobalt lanthanum manganese strontium oxide (co0.2la0.75mn0.8sr0.2o3) 220196-94-1, Cobalt manganese praseodymium strontium oxide (Co0.2Mn0.8Pr0.7Sr0.3O3) 255823-22-4, Manganese praseodymium strontium oxide (MnPr0.65Sr0.3O3) 255823-23-5, Manganese neodymium strontium oxide (MnNd0.65Sr0.3O3) 255823-24-6, Cobalt manganese neodymium strontium oxide (Co0.2Mn0.8Nd0.65Sr0.3O3) 255823-25-7, Gadolinium manganese strontium oxide (Gd0.65MnSr0.3O3) 255823-26-8, Cobalt gadolinium manganese strontium oxide (Co0.2Gd0.65Mn0.8Sr0.3O3) 263248-61-9, Cobalt lanthanum manganese praseodymium oxide (co0.2la0.75mn0.8Pr0.2o3) 313964-49-7 313964-51-1, Cobalt iron lanthanum strontium oxide (Co0.2Fe0.8La0.75Sr0.2O3) 313964-53-3, Cobalt iron lanthanum strontium oxide (Co0.2Fe0.8La0.65Sr0.3O3) 313964-56-6 313964-58-8 313964-59-9 313964-64-6, Manganese samarium strontium oxide (MnSm0.65Sr0.3O3) 313964-66-8, Europium manganese strontium oxide (Eu0.65MnSr0.3O3) **313964-70-4D**, oxygen deficient **313964-72-6D**, oxygen deficient **313964-74-8D**, oxygen deficient

RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PRP (Properties); PROC (Process); USES (Uses)
(alternative materials for components of high-temperature solid-oxide **fuel cell** (**SOFC**) for decrease of operating temps.)

IT 64417-98-7, Yttrium zirconium oxide
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PRP (Properties); PROC (Process); USES (Uses)
(anode; alternative materials for components of high-temperature solid-oxide **fuel cell** (**SOFC**) for decrease of operating temps.)

IT 1313-99-1, **Nickel oxide** (NiO), uses
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PRP (Properties); PROC (Process); USES (Uses)
(anodes; alternative materials for components of high-temperature solid-oxide
fuel cell (**SOFC**) for decrease of operating temps.)

IT **155343-26-3**
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PRP (Properties); PROC (Process); USES (Uses)
(electrolyte; alternative materials for components of high-temperature solid-oxide **fuel cell** (**SOFC**) for decrease of operating temps.)

IT 1314-23-4, **Zirconia**, uses
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PRP (Properties); PROC (Process); USES (Uses)
(yttria-stabilized, anode; alternative materials for components of high-temperature solid-oxide **fuel cell** (**SOFC**) for decrease of operating temps.)

IT 1314-36-9, Yttria, uses
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PRP (Properties); PROC (Process); USES (Uses)
(**zirconia** anodes stabilized with; alternative materials for components of high-temperature solid-oxide **fuel cell** (**SOFC**) for decrease of operating temps.)

IT **177027-87-1D**, oxygen deficient **313964-70-4D**, oxygen deficient **313964-72-6D**, oxygen deficient **313964-74-8D**, oxygen deficient
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PRP (Properties); PROC (Process); USES (Uses)
(alternative materials for components of high-temperature solid-oxide **fuel cell** (**SOFC**) for decrease of operating temps.)

IT **155343-26-3**
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PRP (Properties); PROC (Process); USES (Uses)
(electrolyte; alternative materials for components of high-temperature solid-oxide **fuel cell** (**SOFC**) for decrease of operating temps.)

L89 ANSWER 7 OF 9 HCA COPYRIGHT 2004 ACS on STN

134:44424 Reactivity and interdiffusion of alternative **SOFC** cathodes with yttria stabilized **zirconia**, gadolinia doped ceria and doped lanthanum gallate solid electrolytes. Kostogloudis, G. Ch.; Tsiniarakis, G.; Riza, F.; Ftikos, Ch. (National Technical University of Athens, Greece). EUROMAT 99, Biannual Meeting of the Federation of European Materials Societies (FEMS), Munich, Germany, Sept. 27-30, 1999, Meeting

Date 1999, Volume 13, 175-180. Editor(s): Grassie, K. Wiley-VCH Verlag GmbH: Weinheim, Germany. (English) **2000**. CODEN: 69AMNI.

AB The chemical compatibility between the cathode composition Pr0.8Sr0.2Co0.2Fe0.8O3-δ and the electrolyte compns. yttria stabilized **zirconia** (YSZ), Ce0.8Gd0.2O1.9 (CGO) and La0.8Sr0.2Ga0.9Mg0.1O3-δ (LSGM) was investigated. Also, the influence of the substitution of Al for Fe on the reactivity of the cathode with YSZ was examined All oxides were single phase materials except for LSGM, which contained two addnl. phases, namely LaSrGa3O7 and LaSrGaO4. Two types of expts. were performed: (a) reactivity expts. by XRD in cathode/electrolyte powder mixts. and (b) diffusion expts. by SEM/EDX anal. in cathode/electrolyte double-layer pellets. Pr2Zr2O7, SrZrO3 and CoFe2O4 were formed by the interaction of the cathode materials with YSZ. Substitution by Al at the B-site of the **perovskite** cathode led to a decrease of its reactivity with YSZ. No reaction products were formed for powder mixts. of Pr0.8Sr0.2Co0.2Fe0.8O3-δ and CGO or LSGM electrolytes. High Co and Fe diffusion into LSGM was identified. Pr, La and Ga show a smaller tendency for diffusion. The diffusion of transition metal cations into LSGM electrolyte caused the destabilization and disappearance of the second phases in the interdiffusion zone.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST **fuel cell** cathode reactivity yttria stabilized **zirconia**; gadolinia doped ceria reactivity **fuel cell** cathode; lanthanum gallate reactivity **fuel cell** cathode; **electrolyte** reactivity **fuel cell** cathode

IT Diffusion
(interdiffusion; reactivity and interdiffusion of alternative **SOFC** cathodes with yttria stabilized **zirconia**, gadolinia doped ceria and doped lanthanum gallate solid electrolytes)

IT **Fuel cell** cathodes
Fuel cell electrolytes
Solid state fuel cells
(reactivity and interdiffusion of alternative **SOFC** cathodes with yttria stabilized **zirconia**, gadolinia doped ceria and doped lanthanum gallate solid electrolytes)

IT 64417-98-7, Yttrium zirconium oxide 117655-32-0, Cerium gadolinium oxide Ce0.8Gd0.2O1.9 **177027-87-1D**, Gallium lanthanum magnesium strontium oxideGa0.9La0.8Mg0.1Sr0.2O3, O-deficient 313219-96-4D, Cobalt iron praseodymium strontium oxide (Co0.2Fe0.8Pr0.8Sr0.2O3), O-deficient 313219-97-5D, O-deficient 313219-98-6 313219-99-7D, O-deficient 313220-00-7D, O-deficient
RL: DEV (Device component use); RCT (Reactant); RACT (Reactant or reagent); USES (Uses)
(reactivity and interdiffusion of alternative **SOFC** cathodes with yttria stabilized **zirconia**, gadolinia doped ceria and doped lanthanum gallate solid electrolytes)

IT 12036-39-4, Strontium zirconium oxide SrZrO3 12052-28-7, Cobalt **iron oxide** CoFe2O4 12165-18-3, Praseodymium zirconium oxide Pr2Zr2O7
RL: FMU (Formation, unclassified); FORM (Formation, nonpreparative)
(reactivity and interdiffusion of alternative **SOFC** cathodes with yttria stabilized **zirconia**, gadolinia doped ceria and doped lanthanum gallate solid electrolytes)

IT **177027-87-1D**, Gallium lanthanum magnesium strontium oxideGa0.9La0.8Mg0.1Sr0.2O3, O-deficient
RL: DEV (Device component use); RCT (Reactant); RACT (Reactant or

reagent); USES (Uses)
(reactivity and interdiffusion of alternative **SOFC** cathodes with yttria stabilized **zirconia**, gadolinia doped ceria and doped lanthanum gallate solid electrolytes)

L89 ANSWER 8 OF 9 HCA COPYRIGHT 2004 ACS on STN
130:239566 Conductive substance from mixed oxides and its application.
Ishihara, Tatsumi; Takita, Yusaku (Mitsubishi Materials Corp., Japan).
Ger. Offen. DE 19839202 A1 **19990401**, 18 pp. (German). CODEN:
GWXXBX. APPLICATION: DE 1998-19839202 19980828. PRIORITY: JP 1997-234839
19970829; JP 1998-81184 19980327.

AB Mixed metal-oxide conductors with **perovskite**-type structure are of general formula A1-xCaxGa1-yByO3, in which: (1) A is a lanthanide metal ion (M3+) with octacoordinated ionic radius 1.05-1.15 Å, (2) B is at least one of Co, Fe, Ni, and Cu; and (3) x = 0.05-0.3 and y = 0.05-0.3. In a particular embodiment, the mixed-oxide conductors can be used as electrolytes (e.g., in an air cathode or a gas separation membrane) in a solid oxide **fuel cell**, especially with general formula Ln1-x'Ax'Ga1-y'-z'B1y'B2z'O3, in which: (1) Ln is chosen from La, Ce, Pr, Nd, and Sm, (2) A is chosen from Sr, Ca, and Ba, (3) B1 is chosen from Mg, Al, and In, (4) B2 is chosen from Co, Fe, Ni, and Cu, and (5) x' = 0.05-0.3; yr' = 0.025-0.29; z' = 0.01-0.15; and y' + z' ≤0.3.

IC ICM C01B035-00
ICS H01M004-86; B01D053-22; H01B001-08; H01M004-48

CC 49-4 (Industrial Inorganic Chemicals)
Section cross-reference(s): 52, 76

ST **perovskite** mixed oxide elec conductor; solid oxide **fuel cell** mixed oxide conductor; rare earth **perovskite** elec conductor

IT **Fuel cell** cathodes
(air; mixed metal-oxide conductors with **perovskite**-type structure for use as electrolytes)

IT Rare earth oxides
Rare earth oxides
RL: DEV (Device component use); TEM (Technical or engineered material use); USES (Uses)
(alkaline earth oxides, **perovskite**, elec. conducting; mixed metal-oxide conductors with **perovskite**-type structure for use as electrolytes)

IT **Perovskite**-type crystals
(elec. conducting; mixed metal-oxide conductors with **perovskite**-type structure for use as electrolytes)

IT Membranes, nonbiological
(for gases; mixed metal-oxide conductors with **perovskite**-type structure for use as electrolytes)

IT Solid electrolytes
Solid state fuel cells
(mixed metal-oxide conductors with **perovskite**-type structure for use as electrolytes)

IT Rare earth oxides
RL: DEV (Device component use); TEM (Technical or engineered material use); USES (Uses)
(**perovskite**, elec. conducting; mixed metal-oxide conductors with **perovskite**-type structure for use as electrolytes)

IT Alkaline earth oxides
Alkaline earth oxides
RL: DEV (Device component use); TEM (Technical or engineered material use); USES (Uses)

(rare earth oxides, **perovskite**, elec. conducting; mixed metal-oxide conductors with **perovskite**-type structure for use as electrolytes)

IT **221325-03-7**, Calcium cobalt gallium samarium oxide (Ca0.1Co0.1Ga0.9Sm0.9O3)
RL: DEV (Device component use); TEM (Technical or engineered material use); USES (Uses)
(mixed metal-oxide conductors with **perovskite**-type structure for use as electrolytes)

IT **207739-76-2**, Calcium cobalt gallium neodymium oxide (Ca0.1Co0.1Ga0.9Nd0.9O3) **221325-00-4**, Calcium cobalt gallium neodymium oxide (Ca0.05-0.2Co0.08-0.2Ga0.8-0.92Nd0.8-0.95O3) **221325-01-5**, Calcium cobalt gallium neodymium oxide (Ca0.1Co0.15Ga0.85Nd0.9O3) **221325-02-6** **221325-04-8**, Calcium gallium iron neodymium oxide (Ca0.1Ga0.9Fe0.1Nd0.9O3) **221325-05-9**, Calcium gallium neodymium **nickel oxide** (Ca0.1Ga0.9Nd0.9Ni0.1O3) **221325-06-0**, Calcium copper gallium neodymium oxide (Ca0.1Cu0.1Ga0.9Nd0.9O3) **221325-07-1**, Calcium cobalt gallium neodymium oxide (Ca0.05Co0.1Ga0.9Nd0.95O3) **221325-08-2**, Calcium cobalt gallium neodymium oxide (Ca0.15Co0.1Ga0.9Nd0.85O3) **221325-09-3**, Calcium cobalt gallium neodymium oxide (Ca0.2Co0.1Ga0.9Nd0.8O3) **221325-10-6**, Calcium cobalt gallium neodymium oxide (Ca0.25Co0.1Ga0.9Nd0.75O3) **221325-11-7**, Calcium cobalt gallium neodymium oxide (Ca0.3Co0.1Ga0.9Nd0.7O3) **221325-12-8**, Calcium cobalt gallium neodymium oxide (Ca0.1Co0.05Ga0.95Nd0.9O3) **221325-13-9**, Calcium cobalt gallium neodymium oxide (Ca0.1Co0.2Ga0.8Nd0.9O3) **221325-14-0**, Calcium cobalt gallium neodymium oxide (Ca0.1Co0.25Ga0.75Nd0.9O3) **221325-15-1**, Calcium cobalt gallium neodymium oxide (Ca0.1Co0.3Ga0.7Nd0.9O3)
RL: DEV (Device component use); TEM (Technical or engineered material use); USES (Uses)
(**perovskite**, elec. conducting; mixed metal-oxide conductors with **perovskite**-type structure for use as electrolytes)

IT **221325-03-7**, Calcium cobalt gallium samarium oxide (Ca0.1Co0.1Ga0.9Sm0.9O3)
RL: DEV (Device component use); TEM (Technical or engineered material use); USES (Uses)
(mixed metal-oxide conductors with **perovskite**-type structure for use as electrolytes)

IT **207739-76-2**, Calcium cobalt gallium neodymium oxide (Ca0.1Co0.1Ga0.9Nd0.9O3) **221325-00-4**, Calcium cobalt gallium neodymium oxide (Ca0.05-0.2Co0.08-0.2Ga0.8-0.92Nd0.8-0.95O3) **221325-01-5**, Calcium cobalt gallium neodymium oxide (Ca0.1Co0.15Ga0.85Nd0.9O3) **221325-02-6** **221325-04-8**, Calcium gallium iron neodymium oxide (Ca0.1Ga0.9Fe0.1Nd0.9O3) **221325-05-9**, Calcium gallium neodymium **nickel oxide** (Ca0.1Ga0.9Nd0.9Ni0.1O3) **221325-06-0**, Calcium copper gallium neodymium oxide (Ca0.1Cu0.1Ga0.9Nd0.9O3) **221325-07-1**, Calcium cobalt gallium neodymium oxide (Ca0.05Co0.1Ga0.9Nd0.95O3) **221325-08-2**, Calcium cobalt gallium neodymium oxide (Ca0.15Co0.1Ga0.9Nd0.85O3) **221325-09-3**, Calcium cobalt gallium neodymium oxide (Ca0.2Co0.1Ga0.9Nd0.8O3) **221325-10-6**, Calcium cobalt gallium neodymium oxide (Ca0.25Co0.1Ga0.9Nd0.75O3) **221325-11-7**, Calcium cobalt gallium neodymium oxide (Ca0.3Co0.1Ga0.9Nd0.7O3) **221325-12-8**, Calcium cobalt gallium neodymium oxide (Ca0.1Co0.05Ga0.95Nd0.9O3) **221325-13-9**, Calcium cobalt gallium neodymium oxide

(Ca0.1Co0.2Ga0.8Nd0.9O3) **221325-14-0**, Calcium cobalt gallium neodymium oxide (Ca0.1Co0.25Ga0.75Nd0.9O3) **221325-15-1**, Calcium cobalt gallium neodymium oxide (Ca0.1Co0.3Ga0.7Nd0.9O3)
RL: DEV (Device component use); TEM (Technical or engineered material use); USES (Uses)
(**perovskite**, elec. conducting; mixed metal-oxide conductors with **perovskite**-type structure for use as electrolytes)

L89 ANSWER 9 OF 9 HCA COPYRIGHT 2004 ACS on STN
129:21822 Oxygen ion conductivity in doped lanthanide gallium based **perovskite** oxide. Ishihara, Tatsumi; Furutani, Haruyoshi; Nishiguchi, Hiroyasu; Takita, Yusaku (Department of Applied Chemistry, Faculty of Engineering, Oita University, Oita, 870-11, Japan). Proceedings - Electrochemical Society, 97-24(Ionic and Mixed Conducting Ceramics), 834-843 (English) **1998**. CODEN: PESODO. ISSN: 0161-6374. Publisher: Electrochemical Society.
AB The oxygen ion conductivity was studied of doped LnGaO3 (Ln = Nd, La) **perovskite** phase, obtained by doping Mg into the Ga site up to 30 mol%. The oxide ion conductivity at low temperature increased with doping, from 20 to 30 mol% Mg, however, at high temperature, conductivity is almost independent of the amount of doped Mg, at 10-30 mol %. The optimized composition of LaGaO3 heavily doped with Mg is La0.8Sr0.2Ga0.7Mg0.3O3, which has oxide ion conductivity at 1223 K and 873 K of 0.47 and -1.92 log(α/Scm-1), resp. Doping of Co into the Ga site of NdGaO3 was also studied, in terms of mixed conductivity of oxide ion and holes. Doping a small amount of Co was effective for increasing the elec. conductivity to 0 log(α/Scm-1)at 773-900 K, while the transport number as measured in a H2-O2 cell, is higher than 0.4. Consequently, Co doped Nd0.9Ca0.1GaO3 is also a promising mixed ion conductor.
CC 76-2 (Electric Phenomena)
Section cross-reference(s): 72
ST neodymium gallium oxide cond doping level; lanthanum gallium **oxide magnesium** doping cond; mixed ion lanthanide **perovskite ceramic** conductor
IT Ionic conductivity
Perovskite-type crystals
Transference number
(oxygen ion conductivity in doped lanthanide gallium oxide **ceramic** conductors for **electrochem. cells**)
IT Electric conductors, **ceramic**
(oxygen ion; oxygen ion conductivity in doped lanthanide gallium oxide **ceramic** conductors for **electrochem. cells**)
IT 7439-95-4, Magnesium, uses 7440-48-4, Cobalt, uses
RL: MOA (Modifier or additive use); USES (Uses)
(oxygen ion conductivity in doped lanthanide gallium oxide **ceramic** conductors for **electrochem. cells**)
IT 7782-44-7, Oxygen, processes
RL: PEP (Physical, engineering or chemical process); PROC (Process)
(oxygen ion conductivity in doped lanthanide gallium oxide **ceramic** conductors for **electrochem. cells**)
IT **155343-23-0**, Gallium lanthanum magnesium strontium oxide (Ga0.9La0.9Mg0.1Sr0.1O3) **161576-30-3**, Gallium lanthanum magnesium strontium oxide (Ga0.7La0.9Mg0.3Sr0.1O3) **184176-82-7**, Calcium gallium magnesium neodymium oxide (Ca0.1Ga0.9Mg0.1Nd0.9O3) **207739-74-0 207739-75-1 207739-76-2**, Calcium

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      cobalt gallium neodymium oxide (Ca0.1Co0.1Ga0.9Nd0.9O3)
      207739-77-3, Cobalt gallium lanthanum strontium oxide
      (Co0.1Ga0.9La0.9Sr0.1O3)
      RL: PRP (Properties)
         (oxygen ion conductivity in doped lanthanide gallium oxide ceramic
         conductors for electrochem. cells)
IT    12160-53-1, Gallium lanthanum oxide (GaLaO3)   12207-22-6, Gallium
      neodymium oxide (GaNdO3) 149498-90-8, Calcium gallium neodymium
      oxide (Ca0.1GaNd0.9O3) 207739-73-9
      RL: PRP (Properties)
         (perovskite; oxygen ion conductivity in doped lanthanide gallium
         oxide ceramic conductors for electrochem.
         cells)
IT    155343-23-0, Gallium lanthanum magnesium strontium oxide
      (Ga0.9La0.9Mg0.1Sr0.1O3) 161576-30-3, Gallium lanthanum
      magnesium strontium oxide (Ga0.7La0.9Mg0.3Sr0.1O3) 184176-82-7,
      Calcium gallium magnesium neodymium oxide (Ca0.1Ga0.9Mg0.1Nd0.9O3)
      207739-74-0 207739-75-1 207739-76-2, Calcium
      cobalt gallium neodymium oxide (Ca0.1Co0.1Ga0.9Nd0.9O3)
      207739-77-3, Cobalt gallium lanthanum strontium oxide
      (Co0.1Ga0.9La0.9Sr0.1O3)
      RL: PRP (Properties)
         (oxygen ion conductivity in doped lanthanide gallium oxide ceramic
         conductors for electrochem. cells)
IT    149498-90-8, Calcium gallium neodymium oxide (Ca0.1GaNd0.9O3)
      207739-73-9
      RL: PRP (Properties)
         (perovskite; oxygen ion conductivity in doped lanthanide gallium
         oxide ceramic conductors for electrochem.
         cells)

=> => d his nofile
```